



THE FEASIBILITY OF THE U.S. AIR FORCE MANDATING THE EXCLUSIVE USE  
AND PURCHASE OF FOREST STEWARDSHIP COUNCIL CERTIFIED WOOD  
AND PAPER CONTAINING 100% POST CONSUMER CONTENT

THESIS

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THESIS

Presented to the Faculty  
Department of Systems and Engineering Management  
Graduate School of Engineering and Management  
Air Force Institute of Technology  
Air University  
Air Education and Training Command  
In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Strategic Purchasing

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March 2005

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## **Abstract**

The Resource Conservation and Recovery Act requires federal agencies to purchase products with the highest recovered content (or post consumer content in the case of paper) as practicable. The Office of Federal Procurement Policy requires all executive agencies to give preference in their procurement programs to products that conserve natural resources and protect the environment. These requirements necessitate that the Air Force consider purchasing 100% post consumer content (PCC) paper and Forest Stewardship Council (FSC) certified wood because of their environmentally preferable attributes.

This study compared the availability, performance standards, and prices of 100% PCC paper to 30% PCC paper and FSC-certified wood to uncertified wood. Life cycle costs were included in the price comparisons. It was determined that 100% PCC paper was equally available; met the same performance standards; and could be found at prices equal to or less than the price of 30% PCC paper. It was also determined that FSC-certified wood met the same performance standards as uncertified wood, but was not readily available. Additional data would be required to compare the price of FSC-certified wood to uncertified wood. For these reasons, it was determined that it would be feasible for the Air Force to require the exclusive use and purchase of 100% PCC paper and not feasible to require the exclusive use and purchase of FSC-certified wood.

*To My Husband and Daughter*

**Acknowledgements**

I would like to thank Lieutenant Colonel Ellen England, Lieutenant Colonel (select) Bryan Hudgens and Major Jeffrey Smith for their constant support and patience. Without their encouragement, insight, and refreshing enthusiasm for the environment, none of this would be possible. I would also like to thank God, my husband, and my daughter -- my three best sources of motivation.

Silinda Johnson

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## **1.0 Introduction**

### **1.1 Background**

The world's forests are a natural resource used by countless industries and individuals around the globe. Yet, the health of these forests is threatened by the change in the world's land use with time. Estimates of the percentage of the world's original forests degraded or lost range from 50 percent (UNEP, 2004) to 80 percent (Bryant, Nielson, & Tangleay, 1997). Because the U.S. is the single largest consumer of forest products (North American Forest Commission, 2000), the sustainability of the world's remaining forest is rightly of interest to the U.S. government. In fact, the federal government has implemented several policies intended to improve the nation's natural resource conservation efforts.

At the heart of federal conservation is the control of federal government consumption by regulating the purchase and use of goods. The Resource Conservation and Recovery Act of 1976 was the first major environmental law to require federal agencies to purchase items containing the highest percentage of recovered materials practicable (42 U.S.C. § 6962(c)(1)). The purchase of products made of recovered materials serves two purposes: 1) the conservation of virgin resources; and 2) the diversion of discarded materials from

the waste stream. In 1991, Executive Order 12780, *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy*, was signed in an effort to increase the level of recycling and the purchase of recycled-content products. The government's support for recycling was reaffirmed with the issuance of Executive Order 12873, *Federal Acquisition, Waste Prevention, and Recycling* in 1993. Most notably, this order created the Office of the Federal Environmental Executive (OFEE) that uses the term “green purchasing,” to describe the “acquisition of recycled content products, environmentally preferable products and services, biobased products, energy and water efficient products, alternative fuel vehicles, and products using renewable energy” (OFEE, 2004). In 1998, Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition*, replaced Executive Order 12873 and created the White House Task Force on Waste Prevention and Recycling to further promote federal purchases of recovered content and other environmentally preferable products. Finally, in 2000, Executive Order 13148, *Greening the Government through Leadership in Environmental Management*, gave each federal agency the responsibility of taking all necessary actions to incorporate environmental accountability into both day-to-day and long-term decision-making and planning.

Despite the existence of the aforementioned laws and Executive Orders, which will collectively be referred to as conservation policies, they are often neglected when purchases are made for trivial items with small price tags. Employees, like most consumers, are not trained to look at recycled content when purchasing a ream of office paper; instead, they are given a credit card and sent to the local office supply store where all else equal, they are expected to purchase the least expensive ream. Ignored is the fact

that there are hundreds of organizations buying hundreds of thousands of reams of paper each year. The cumulative scope of these purchases warrants adherence to the conservation policies because the total environmental and economic impact may be great.

The Air Force will hopefully move towards remedying these impacts as it sets up centralized sourcing strategies called Commodity Councils to leverage its buying power for various commodities. For example, with Commodity Councils, the Air Force will consolidate the paper requirements for all its installations and award a few contracts to meet its paper needs rather than allow each installation to purchase its own paper. Two important things will result from the consolidation: 1) the Air Force will finally be aware of the total cost of commodities and quantities purchased; and 2) with consolidated quantities, environmental impacts will become more apparent.

## **1.2 Problem Identification**

This study addresses two major problems. The first problem relates to the current conservation policies and consists of three basic issues. First, the current conservation policies have not kept pace with market realities. For example, since 1998, the required minimum recovered content for paper purchased by the Air Force has remained at 30 percent despite today's availability of 100 percent recycled paper (FAR 11.303(b), 2004). Second, while broad enough to justify the purchase of any higher-priced environmentally preferable product alternative, the current conservation policies mandate that only 56 products purchased contain a minimum recovered content as designated by the U.S. Environmental Protection Agency (EPA) (EPA, 2004). This being the case, the Air

Force is given the flexibility to meet or exceed this minimum although there is no incentive for the Air Force to exceed the minimum. Third, the conservation policies lack enforcement capabilities. If the Air Force fails to comply, the sole consequence is that the Air Force is required to document the reason for the failure – and there is no structure provided for failure reporting, inspection of purchases, or assessment of penalties.

The second major problem is the Air Force's definition of reasonable pricing. The requirement to purchase EPA-designated products that meet the minimum recovered content can be avoided if the products are only available at an unreasonable price (42 U.S.C. § 6962(c)(1)(C)). The Air Force has further defined unreasonable price to mean a price equal to or less than the price of non-recycled alternatives (HQ AFCEE, 2004). By considering only the upfront sale price of products, the Air Force is inconsistent with Executive Order 13148 that encourages federal agencies to apply life cycle assessment and environmental cost accounting principles to decision-making and planning. For example, with its definition, the Air Force does not acknowledge the possibility that purchasing certified wood products at higher prices might provide greater life cycle benefits than the purchase of uncertified wood products at equal or lower upfront prices.

### **1.3 Research Questions/Objectives**

The purpose of this research was to determine if it would be feasible for the Air Force to mandate the exclusive use and purchase of Forest Stewardship Council (FSC) certified wood and 100% percent post consumer content (PCC) paper. The following

investigative questions were answered to gather data to support the feasibility determination.

(1) What type of paper and wood products is the Air Force currently required to purchase?

(2) If the Air Force is required to purchase certain paper or wood products, how were the requirements determined and who was responsible for establishing and enforcing them? How can these requirements be changed?

(3) If the Air Force is required to purchase certain paper or wood products, is it complying with the requirements?

(4) How much paper and wood does the Air Force consume annually?

(5) What paper and wood products are currently available commercially and to what extent?

(6) What benefits could result from the U.S. Air Force's use of paper containing 100 percent post consumer materials and certified wood products?

(7) What is the cost to the U.S. Air Force for purchasing certified wood and paper containing 100 percent post consumer materials?

#### **1.4 Scope**

The forest product consumption rates, costs, and benefits to the entire active duty Air Force were examined in this research. Any recommendations derived from this research are applicable only to the active duty Air Force and not the Air Force Reserve or Air National Guard.

This research was limited in two ways. First, all data pertaining to paper was restricted to white, size A (8.5 x 11 in) paper compliant with the U.S. Government Printing Office (GPO) paper specification JCP O-65, *PLAIN COPIER, XEROGRAPHIC, WHITE AND COLORED* (GPO, 1999). These limitations were set because of the infinite shapes, colors, and sizes of paper that were found in the market. Second, despite the existence of several other forest certification systems, costs and benefits associated with certified wood were limited to wood harvested in forests certified by the FSC because it is a prominent, third-party certification system.

## **1.5 Approach/Methodology**

In fiscal year 2004, the Air Force was required to purchase EPA-designated products that contain the minimum recovered content prescribed by the EPA unless the items are only available at an unreasonable price; fail to meet performance standards; or are not reasonably available within a practical period of time (42 U.S.C. § 6962(c)(1)(A-C)). In this study, if none of the exemption criteria applied to the purchase of FSC-certified wood or paper with 100% PCC paper, then mandating the purchase of these items was deemed feasible. Life cycle cost-benefit analyses, literature reviews, and market research were conducted to determine the applicability of the first exemption, while additional market research was used to determine if either the second or third exemptions applied.

Determining the applicability of the first exemption was considered the most critical portion of this study. Price reasonableness was based on a life cycle cost-benefit analysis comparing the purchase of the environmentally preferable products to their currently

purchased counterparts. Two separate cost-benefit analyses were performed. Each cost-benefit analysis consisted of five steps (Poch, Gillette, and Veil, 1998). The first step was the development of the baseline and alternative. These were developed directly from the research problem--the baselines were the status quo and the alternatives were the purchase of FSC-certified wood or 100% PCC paper. The next two steps were the identification and analysis of benefits and costs. Published literature was searched, Air Force purchasing and consumption data was collected, and market research was conducted to find potential costs and benefits for both the baseline and alternatives. The fourth step was the evaluation of benefits and costs by discounting future values to find the present value (PV) in 2004 dollars. The discount rate was selected based on literature reviewed. The formula that was used to calculate PV is shown in Equation 1-1 (Mathis, 2004).

$$PV = \frac{CF_t}{(1+r)^t} \quad (1-1)$$

where

- PV = Present Value
- CF<sub>t</sub> = Future Cash Flow which occurs t years from now
- r = the interest or discount rate
- t = the number of years

The last step was the comparison of the benefits and costs using the net present value (NPV) technique. The baseline or alternative with the highest positive NPV was considered the best value for the Air Force. If the environmentally preferable alternatives had the highest NPVs, they were considered competitively priced. The formula that was used to calculate NPV is shown in Equation 1-2 (Mathis, 2004).

$$NPV = \sum_{t=0}^T \frac{CF_t}{(1+r)^t} = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_T}{(1+r)^T} \quad (1-2)$$

where

- $CF_t$  = the cash flow at time  $t$  and
- $r$  = the cost of capital.

The second exemption applied if the environmentally preferable products failed to meet the performance standards of their currently purchased counterparts. To check the applicability of this exemption, the performance standards of the products purchased in fiscal year 2004 were identified and market research was conducted to find the performance specifications of the environmentally preferable alternatives. Then the specifications were compared to determine if differences existed.

The third exemption applied if the environmentally preferable products were not reasonably available within a practical period of time. To check the applicability of this exemption, market research was conducted first to determine what the *reasonable* delivery time was for the products purchased in fiscal year 2004. Then, market research was used to identify available delivery times for the environmentally preferable products. Last, the delivery times were compared.

If the results show that FSC-certified wood and 100% PCC paper were competitively priced, met performance standards, and were reasonably available, the requirement to use and purchase FSC-certified wood and 100% PCC paper was considered feasible.

## 1.6 Significance

Congressional legislation and Presidential Executive Orders require all federal agencies to purchase environmentally preferable products to the maximum extent

practicable over other competing products; however, most agencies appear to limit their environmentally preferable purchases to the minimum required. By mandating the exclusive use and purchase of FSC-certified wood and 100% PCC paper, the Air Force would exceed the federal minimum requirements and could be recognized as a benchmark in environmental stewardship through green procurement. This would be especially significant at a time when purchases of these items will be centralized through Commodity Councils that would ensure the compliance of all Air Force purchases. Additionally, if the cost-benefit analysis shows that the net present value of purchasing these products outweighs the net present value of purchasing the less environmental alternatives, the Air Force will benefit economically as well as environmentally.

## **1.7 Summary**

To aid in the sustainability and recovery of the world's forests, the U.S. as the largest consumer of forest products, must control its consumption and embrace conservation efforts. The federal government took the first step and issued several conservation policies for federal agencies to follow. More importantly, the federal government provides a minimum environmental standard for its agencies, but also gives its agencies the flexibility to do more. The goal of this research was to provide the Air Force with sound information upon which to make the decision to do more for the environment based on environmental, social, and economic costs and benefits.

## **2.0 Literature Review**

### **2.0 Introduction**

Former U.S. President William Clinton issued an Executive Order stating

The head of each Federal agency is responsible for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes, across all agency missions, activities, and functions. Consequently, environmental management considerations must be a fundamental and integral component of Federal Government policies, operations, planning, and management. (E.O. 13148 § 101, 2000)

The purpose of this study was to determine if it would be feasible for the Air Force to mandate the exclusive use and purchase of Forest Stewardship Council (FSC) certified wood and 100% post consumer content (PCC) paper. Both of these products were considered to be environmentally preferable to their counterparts and the purchase of these items would be supported by Executive Order (E.O.) E.O. 13148. In the following sections, the wood and paper products in question are further described and additional rationale for purchasing environmentally preferable products is provided.

### **2.1 Forests and the Environment**

It is estimated that the U.S. was covered with 423 million hectares of forest land (46% of U.S.) in 1630, 307 million hectares by 1907, and 302 million in 1997 (Forest Service, 2000; 3). Despite the relative stability of forest area since 1907, forests have been changing: some forests were converted to other uses, some urban land became forests,

and those forests that were never converted to other uses changed in age and composition (Forest Service, 2000; 3). A forest is a natural, renewable resource that among other things provides watershed protection, nutrient cycling, carbon storage, air pollution reduction, microclimatic regulation, and wood (Bishop, 1998; 3). Since 82.6% of the forests in the eastern U.S. and 31.1% of the forests in the western U.S. are privately owned (Forest Service, 2000; 6-7), it is important for the government and these private forest owners to understand and sustain the value of their forests. The certification of forests is assurance that a forest is being managed in a sustainable manner. If the Air Force required the use of FSC-certified wood, the Air Force would be supporting sustainable forestry management.

## **2.2 Wood Products**

Although the Air Force uses a variety of wood products, from furniture to wood flooring, this study was limited to building lumber. Specifically, FSC-certified and uncertified 2" x 4" x 8' framing lumber (FSC-certified wood and uncertified wood respectively) was considered in this study. It was acknowledged that although worthy of FSC certification, some companies choose not to get FSC certified or perhaps choose to be certified by another organization. For the purposes of this study though, uncertified wood was considered to be wood harvested in such a way as to cause the most negative impact on the environment, while FSC-certified wood represented wood harvested in the most environmentally preferable manner. Other than the differences in their origins, FSC-certified wood and uncertified wood were considered to be identical.

Voluntary forest and wood product certification began in the late 1980s. As of 2002, more than 300 million acres of forests worldwide were certified (Vlosky, Gazo, & Cassens, 2003; 76). Two types of certification systems existed: certification of forestry management practices and chain of custody certification of wood products. Forestry management certification protects forests by requiring sustainable forestry practices. Chain of custody certification ensures that only wood harvested from a certified forest is labeled as such. North America had four major certification systems: The American Tree Farm System, The Forest Stewardship Council, The Sustainable Forestry Initiative, and CSA International. Each of these systems differed from the others, but they all evaluated forests against defined sustainability standards that generally address environmental performance, social responsibility, and economic viability (Metafore, 2004). Table 2.1 compares the four certification systems in detail.

**Table 2.1. Comparison of Major Forest Certification Systems in the U.S. (Metafore, 2004)**

	American Tree Farm System	CSA International	Forest Stewardship Council	Sustainable Forestry Initiative
<b>Scope</b>	U.S.: Private, non-industrial	Canada: All types	Global: All types	U.S., Canada: industrial
<b>Issues Covered</b>	environmental silvicultural social economic	environmental silvicultural social economic	environmental silvicultural social economic	environmental silvicultural social
<b>3rd Party Independent Certification</b>	3rd party required Initial: Volunteer foresters Audits: 5 years Re-certification: none	3rd party required Initial: Accredited registrars, independently certified auditors Audit: 1 year Re-certification: 3 years	3rd party required Initial: Accredited certifiers Audit: 1 year Re-certification: 3 years	3rd party OPTIONAL Initial: Accredited registrars, independently certified auditors Audit: 3 years, 1 year for label users Repeat audit: 5 years
<b>Chain of Custody</b>	None	Yes	Yes	Auditable monitoring system
<b>Label</b>	None	Yes. Minimum threshold is 70%. Product labels required to conform to ISO 14020, ISO 14021.	Yes. Minimum threshold varies with product. 70% for solid wood.	Yes, for third-party certifications only. Minimum threshold is 66%.
<b>Number of participants</b>	65,000 Certified Tree Farmers	8 companies 38 certificates 34 Forest Mgt 4 COC 1 country	3341 companies 3904 certificates 639 Forest Mgt 3261 COC 74 countries	130 AF&PA members 80 additional 2 countries
<b>Total acreage</b>	US: 26,000,000	Canada: 60,340,840	112,714,608 global 23,592,910 North America.	141,000,000 U.S., Canada 103,000,000 3rd party certified
<b>Endorsement</b>	128 American Forest Foundation	45 Canadian organizations	499 organizations in 59 countries	45 U.S. and Canadian organizations

To limit the complexity of this study, the Forest Stewardship Council (FSC) was the only certification system analyzed. The FSC offers an independent, third-party audit of both forestry management systems and chains of custody. The FSC also does not limit its scope so that forests around the globe can seek its certification. The FSC considers environmental, social, silvicultural (forest age, spatial arrangement, and species composition) and economic issues when developing the standards that FSC forests must meet. Lastly, the FSC is endorsed by nearly 500 organizations worldwide.

The FSC, established in 1983, is a non-profit international organization focused on developing forest management standards and teaching these standards to the forest

products industry and the marketplace. With membership open to all involved in forestry and forest products, the organization is made up of environmentalists, timber and forestry professionals, indigenous people's organizations, and community and social groups from all parts of the world (Forest Stewardship Council, 2004). This diverse membership helps to ensure that multiple viewpoints are considered when developing sustainable forestry standards. In fact, the FSC has divided its membership into three chambers for voting purposes: social, economic, and environmental (Forest Stewardship Council, 2004).

Although the FSC develops standards, it does not actually perform forest or chain of custody assessments. Instead, the FSC accredits and monitors independent certification entities that conduct evaluations to FSC standards. Currently, there are 10 principles and 57 criteria that are applicable to all FSC certified forests and forest products outlined in Appendix A. These principles and criteria deal with multiple benefits including legal issues, labor rights, indigenous rights, and environmental issues in forest management (Forest Stewardship Council, 2004).

To have their forests certified forest managers enter a contractual relationship for an assessment with a certifier. The public is then notified about the future assessment and is encouraged to provide input. At the conclusion of the assessment, if the certifier finds the management practice to be certification-worthy, the forest manager is invited to enter a second contract that officially certifies the forest. At this point, forest products originating from the certified forest can carry the FSC label which differentiates them from other products. The five-year certification contract requires annual compliance audits. At the termination of the contract, the forest management practice must undergo

another complete assessment to become certified again (Forest Stewardship Council, 2004).

### **2.2.1 Forest Benefits.**

This study assumed that FSC-certified forests maximized all of the benefits typically provided by a healthy forest to society. Additionally, an assumption was made that uncertified forests lost all of the benefits typically provided by a healthy forest. These potential benefits can be divided into four categories: direct use values, indirect use values, option values, and existence/bequest values (Kengen, 1997). Specifically concerning forests, direct uses can further be classified as either consumptive uses such as timber, pulpwood, and fuelwood; or non-consumptive uses like recreation. The indirect use values of a forest include watershed protection, nutrient recycling, soil fertilization, gas exchanges such as carbon dioxide and oxygen, climate stabilization, carbon storage, habitat provision, biodiversity protection, aesthetics, and cultural and spiritual values. Option values are the values people place on knowing they have the option to use a forest in the future. Existence and bequest values include the values people place on knowing that they have preserved the existence of a forest or that they have left a forest for future generations (Kengen, 1997).

## **2.3 Paper Products**

Paper was manufactured in a plethora of sizes, colors, and quantities; however, this study considered only bright white, size A (8.5" x 11") multipurpose office containing 30% or 100% post consumer content (PCC). Additionally, an assumption was made that

the remaining content of 30% PCC paper was composed of virgin materials (wood).

Other than the differences in material content, 30% PCC paper and 100% PCC paper were considered to be alike in virtually all aspects.

### **2.3.1 The Paper Life Cycle.**

Although 30% PCC paper and 100% PCC paper may look, feel, and function alike, their life cycles differ from pre-manufacturing to disposal. For paper containing virgin materials or wood pulp, the process begins with the harvest and processing of wood and ends with the paper's disposal or incineration. The life cycle of 100% PCC paper begins and ends with waste paper recovery. For paper like 30% PCC paper that contains both virgin and post consumer materials, processes from both life cycles are involved. From wood harvest to waste paper recovery, every process has some impact on the environment such as air quality reduction, waste generation, and habitat destruction. These impacts along with the prices of 30% and 100% PCC paper were evaluated.

## **2.4 Reasons to Purchase Environmentally Preferable Products**

### **2.4.1 Ecological Economics.**

Whereas previously, the deterioration of environmental quality was often viewed as a necessary cost of economic growth (Hufschmidt et al., 1983, 1); environmental quality is increasingly being viewed as essential to ecosystem health, social welfare, and economic development (Dixon et al., 1994:3). In fact, a new field of economics, *ecological economics*, spurred from an interest in combining environmental and economic analysis (Dixon et al., 1994:4).

The economic value of a good or service is equal to the maximum amount of something a person is willing to give up in order to receive more of that good or service (King and Mazzotta, 2004). Dollars are a convenient measure of economic value because the amount that people are *willing to pay* for something reflects how much they are willing to give up to get it (King and Mazzotta, 2004). As stated above, four categories of values can be assigned to a forest: direct use values, indirect use values, option values, and existence/bequest values (Kengen, 1997). Market prices generally reflect the dollar values associated with direct use values and option values; but indirect and non-use values are often overlooked (Bishop, 1998:2).

Indirect and non-use values are easily neglected because the environment generally provides these goods and services at no cost to society. For example, it is unlikely that anyone specifically pays for the watershed protection, carbon sequestration, and soil retention that a forest provides, but these services increase social welfare nevertheless (Hufschmidt et al., 1983:1). In fact, the free contributions provided by the environment create a positive situation for society where the *consumers' surplus* or difference between the amount paid and the benefits received by society (Dixon et al., 1994:25) is very large (society pays zero dollars for three major services listed previously). The *valuation* or assignment of monetary values to these environmental services (Dixon et al., 1994:4) could enhance society's appreciation for the environment, or at least make society aware of the value lost when decisions are made that negatively impact the environment.

Many valuation techniques are available. To quantify direct use values, the market price and travel cost methods are often used. The market price method estimates the economic values of environmental products and services based on the quantities

purchased and supplied at different prices in the market (King and Mazzotta, 2004). For example, the timber industry may estimate a forest's value by calculating the amount of wood that can be harvested and sold and multiplying this number by the observed price of wood in the market. The travel cost method estimates services like the recreational value of an area by totaling the amount of time and money people are willing to spend in order to visit that area (Farber et al., 2002:389).

Several other valuation techniques can be used to estimate indirect and non-use values. The hedonic pricing method often uses real estate prices for valuing environmental amenities in a local area (King and Mazzotta, 2004). For instance, homes on wooded lots are often priced higher than homes that are otherwise equivalent, but not located on the wooded lots. This price difference signifies the value that people assign to wooded property. The damage cost avoided method estimates the value of an environmental service by estimating the cost of damages that would occur if the environmental service were lost (Farber et al, 2002:388). For example, soil retention by a forest circumvents damages caused by stream sedimentation. The cost of cleaning up a stream full of sediment represents the value of the forest's soil retention services. The substitute cost method estimates that the value of an environmental service is equal to the cost of substituting the service with manmade technology (King and Mazzotta, 2004). For example, the water filtration services that a forest provides can be substituted with manmade filtration technology, the cost of which would represent the value of the forest's services. The replacement cost method is similar to the substitute cost method; however, the value of an environmental service is estimated by measuring the cost of replacing or restoring the system (Farber et al., 2002:388). And finally, the benefit

transfer method uses information from completed studies to value a similar environmental service (King and Mazzotta, 2004). The benefit transfer method is used most often when time or funding available for valuation is limited.

#### **2.4.2 Federal Requirements.**

The purchase of environmentally preferable products like FSC-certified wood and 100% PCC paper is consistent with several federal laws and documents. Some of the documents, like Executive Order 13148, *Greening the Government through Leadership in Environmental Management* (2000), did not specifically dictate purchasing strategies, but rather encouraged environmental stewardship from a broader perspective. It required the head of each agency to ensure that all necessary actions were taken to incorporate environmental accountability into day-to-day decision-making and long-term planning processes, across all functions (E.O. 13148 § 101, 2000). It also made the head of each agency responsible for establishing and actively endorsing strategies supporting environmental leadership programs, policies, and procedures (E.O. 13148 § 201, 2000). Environmentally preferable purchasing is consistent with both of these requirements. Other documents, like the Office of Federal Procurement Policy (OFPP) letter 92-4, regulated agency purchases directly. It required agencies to employ cost-effective preference programs favoring the purchase of environmentally-sound products (Burman, 1992: 6). The letter also demanded that agencies give preference to products that conserve natural resources and protect the environment (Burman, 1992: 6.b.) citing that the benefit of doing so reduces the cost of government and helps to make the government a model consumer (Burman, 1992: 5). Several other documents that specifically regulate

purchasing practices in an attempt to achieve environmental benefits are discussed in the following sections.

#### **2.4.2.1 Affirmative Procurement Programs.**

The first law to contain language promoting the increase of federal purchases of environmentally preferable products was the Resource Conservation and Recovery Act (RCRA) of 1976. Its requirements were echoed and supplemented by the following documents relevant to this study: the Office of Federal Procurement Policy (OFPP) letter 92-4, *Procurement of Environmentally-Sound and Energy-Efficient Products and Services* (1992), Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition* (1998), the *Department of Defense Green Procurement Strategy* (2004), the *Guide to Green Purchasing: the Air Force Affirmative Procurement Program* (2002), and the *Federal Acquisition Regulation (FAR) Part 23.404*. RCRA stated that agencies must purchase products composed of the highest percentage of recovered materials, or post consumer materials in the case of paper, as practicable for products on which an agency spends more than \$10,000 a year (42 U.S.C. § 6962 (a)). But, if an item with the highest percentage of recovered materials is not reasonably available within a practical period of time; fails to meet performance standards; or is only available at an unreasonable price, an agency can justifiably decide not to purchase that item (42 U.S.C. § 6962 (c)(1)(A-C)). Furthermore, it would not be *practical* to purchase such products if there were not enough suppliers to maintain a satisfactory level of competition (42 U.S.C. § 6962 (c)(1)).

To maintain appropriate levels of competition, agencies are obligated to try to increase and expand markets for recovered materials through preference and demand for

products made from such materials (E.O. 13101 § 101, 1998). Since agencies are not expected to be experts on recovered materials, agencies are encouraged to seek assistance from the U.S. Environmental Protection Agency (EPA) that was charged with the task of formally *designating* products that are or can be manufactured from recovered materials (42 U.S.C. § 6962 (e)(1)). The EPA also became responsible for preparing, and “from time to time” revising, guidelines that provide price, performance, and availability information about such *EPA-designated* products (42 U.S.C. § 6962(e)). The EPA accomplishes the above through a combination of two publications: the Comprehensive Procurement Guidelines (CPG) and the Recovered Materials Advisory Notices (RMANs). In the CPG, the EPA designates products that can be manufactured with recovered materials. Then for each product listed in the CPG, the EPA considers the availability of the product, the volume of solid waste created by the product at disposal, the economic and technological feasibility of producing the product, and other uses for the recovered material before publishing a minimum recovered content level for the product in the RMANs (42 U.S.C. § 6002(e)(2)(A-D)). Once the CPG and RMAN for an EPA-designated product are published, agencies have one year to develop an *affirmative procurement program* for that item.

An affirmative procurement program is a program particularly focused on assuring that items composed of recovered materials are purchased to the maximum extent practicable (42 U.S.C. § 6962 (i)(1)). Paper is an EPA-designated product for which a minimum post consumer content of 30 percent is required (EPA, 1999). Thus, each agency must have an affirmative procurement program for the purchase of paper with 30 percent PCC.

Again, affirmative procurement programs are only required if an agency spends more than \$10,000 annually on the EPA-designated product, but the FAR, the regulations that govern all purchases made by agencies, adds that affirmative procurement programs must provide guidance for purchases at or below the micro-purchase threshold (FAR § 23.404(c)), typically \$2,500. Each affirmative procurement program must contain at a minimum: a recovered materials preference program that provides for the maximum use of post consumer materials where paper is concerned; a promotion program to promote the preference program; a program requiring estimates of the percentage of recovered material used per contract; a program requiring the certification of a product's minimum recovered material content; and an annual review and monitoring program to measure the effectiveness of the affirmative procurement program (42 U.S.C. § 6962 (i)(2)). Since each program must provide for the *maximum use* of post-consumer material, affirmative procurement programs provide rational justification for the purchase of paper with 100 percent PCC. Agencies are also required to set goals to maximize their purchases of recycled items over purchases of non-recycled alternatives (E.O. 13101 § 601(b), 1998). Perhaps this could also be used as justification for the purchase of 100% PCC paper over paper with only 30 percent.

#### **2.4.2.2 Environmentally Preferable Purchasing.**

In addition to producing guidelines concerning EPA-designated products, the EPA was tasked with publishing guidelines that address *environmentally preferable purchasing* (E.O. 13101 § 503(a)). Environmentally preferable purchasing is a concept broader than affirmative procurement in that it is not limited to the purchase of items containing recovered materials. In fact, it is open to the purchase of any product that has

a reduced effect on the environment when compared with competing products (E.O. 13101 § 201, 1998). Environmentally preferable purchasing provides suitable rationale for the purchase of FSC-certified wood and paper with 100 percent PCC.

In its *Final Guidance on Environmentally Preferable Purchasing for Executive Agencies* (1999), the EPA published five guiding principles to assist agencies with their efforts to include environmentally preferable purchasing in their programs.

Guiding Principle 1: Environment + Price + Performance = Environmentally Preferable Purchasing

Guiding Principle 2: Pollution Prevention

Guiding Principle 3: Life Cycle Perspective/Multiple Attributes

Guiding Principle 4: Comparison of Environmental Impacts

Guiding Principle 5: Environmental Performance Information

Within these principles, the EPA asserted that pollution prevention is the key reason for purchasing environmentally preferable products, but not the only reason. Because products have impacts on the environment before, during, and after the government purchases and uses them, agencies should purchase products with the least negative environmental impacts in as many life cycle stages as possible. In fact, in their solicitations for proposals, agencies should state that environmental attributes will be part of the basis for competition in addition to traditional factors like price and performance. By seeking and considering environmental information, agencies could send a clear signal that their preference lies with those suppliers who consider the effect of their product's life cycle on the environment. And suppliers that can optimize all competitive factors will capture the majority of the agencies' marketshare. The EPA pointed out that

agencies have the flexibility to give such preference under the context of *best value*--paying a price premium for an environmentally preferable product is roughly equivalent to paying a premium for higher quality. Although the EPA's guidance document is merely *guidance*, the FAR essentially implements the five guiding principles and requires, among other things, that agencies realize life-cycle cost savings and "implement cost-effective contracting preference programs promoting energy-efficiency, water conservation, and the acquisition of environmentally preferable products" (FAR § 7.101).

#### **2.4.2.3 Federal Compliance and Enforcement.**

Although the laws and documents mentioned above clearly show the government's preference towards the purchase of environmentally preferable products like FSC-certified wood and 100% PCC paper, the documents neglect to offer agencies incentive to comply. First, there are exceptions to the requirements. With regards to the requirement to purchase EPA-designated products that contain the minimum recovered content prescribed by the EPA, RCRA gave agencies three scenarios under which exemptions could apply: if the items are only available at an unreasonable price; fail to meet performance standards; or are not reasonably available within a practical period of time (42 U.S.C. § 6962(c) (1) (A-C)). Since it is left to the agencies to determine the *reasonableness* of an item's price or availability and there is no requirement to report the use of an exemption, these scenarios are likely to be prevalent. Second, concerning the purchase of some environmentally preferable products, there is no obvious direct benefit to an agency (HQ AFCEE, 2002; 2). If an agency chooses to purchase these products even though one of the three exemptions may apply, the agency must be satisfied in knowing that its choice will benefit society as a whole—there are no budgetary incentives

or disincentives to sway an agency's decision. This makes it difficult for agencies to rationalize spending more of their limited budget on higher priced consumable products like FSC-certified wood or paper with 100 percent PCC, when most users will not even notice the difference. Third, there are no prescribed penalties for non-compliance. Regulations without provisions for compliance inspections and enforcement have little influence over purchasing decisions.

## **2.5 Summary**

The literature reviewed identified federal support for the purchase of environmentally preferable products, economic concern for the ecological impacts of the various uses of natural resources, and the potential benefits and costs of purchasing FSC-certified wood over uncertified wood and 100% PCC paper over paper with 30 percent PCC. This information has provided a firm background on which to conduct a feasibility study for the purchase of FSC-certified wood and paper with 100 percent PCC.

## **3.0 Methodology**

### **3.1 Introduction**

The goal of this study was to determine if it would be feasible for the Air Force to mandate the exclusive use and purchase of Forest Stewardship Council (FSC) certified wood and 100% post consumer content (PCC) paper. Currently, the Air Force is required to purchase 30% PCC paper and there is no requirement to purchase FSC-certified wood. The overall methodology for this study was derived from the regulation that requires federal agencies to purchase EPA-designated products that contain the minimum recovered content (or post consumer content in the case of paper) prescribed by the EPA *unless* the items are only available at an unreasonable price; fail to meet performance standards; or are not reasonably available within a practical period of time; (42 U.S.C. § 6962(c) (1) (A-C)). To assess the applicability of the first exemption, unreasonable price, two life cycle cost-benefit analyses were conducted—one for wood and one for paper. Data for the life cycle cost-benefit analyses were gathered through market research and literature reviews. To check the applicability of the second and third exemptions concerning wood and paper, additional market research was conducted. If the results of this methodology showed that none of the three exemptions applied to the purchase of FSC-certified wood or 100% PCC paper, the exclusive use and purchase of these products was considered feasible.

Because it was used in determining the applicability of all three exemptions listed above, a detailed explanation of market research is provided here. *Market research* is

“the process of collecting, organizing, maintaining, analyzing, and presenting data that enables activities to achieve the best value acquisition of products” (DAU, 2004).

Further, market research is a continuous process and the data gathered on products, market capabilities, and business practices are utilized to measure trade-offs among the various ways of meeting a requirement (DAU, 2004). There are no limits to the number or type of resources used in market research. For this study, the main sources of data were the world-wide web, published literature, and Air Force contracting offices.

### **3.2 Assessing Exemption Applicability: Unreasonable Price**

In this study, if the prices of the environmentally preferable products (FSC-certified wood and 100% PCC paper) were greater than the prices of the currently purchased counterparts (uncertified wood and 30% PCC paper respectively), the prices of the environmentally preferable products were unreasonable (HQ AFCEE, 200s; DoD, 2004). Rather than solely comparing the *market prices*, or price tags of the products, this study compared life cycle costs--the cost to the Air Force of acquiring, operating, supporting, and disposing of the products (FAR § 7.101), as well as the costs of environmental and economic aspects and potential impacts of a product during its lifetime (EO 13101, 1998).

These life cycle costs were compared using two cost-benefit analyses, one for wood and one for paper. A cost-benefit analysis is a tool that compares the savings resulting from a change with the cost of making the change (Contract Pricing Reference Guides, 2002). Logically for any cost-benefit analysis, if the savings resulting from a change are

greater than the costs, the change is worth pursuing. A method employing five steps common to various cost-benefit analyses performed by the EPA was chosen for this study: Step 1: develop the baseline and alternatives; Step 2: identify and analyze the benefits; Step 3: identify and analyze the costs; Step 4: evaluate the benefits and costs; and Step 5: compare the benefits and costs (Poch et al, 1998). Since two products, wood and paper, were examined in this study, two separate life cycle cost-benefit analyses were performed.

### **3.2.1 Step 1: Develop the Baseline and Alternatives.**

If the Air Force made no changes to its purchasing requirements from fiscal year 2004, it would continue to purchase uncertified wood and 30% PCC paper (FAR §11.303). These two products represented the baseline products for this study. The alternative products, FSC-certified wood and 100% PCC paper were selected because they were environmentally preferable alternatives to the baseline products and were available in fiscal year 2004.

### **3.2.2 Steps 2 and 3: Identify and Analyze the Benefits and Costs.**

Before life cycle costs and benefits were compared, the Air Force's annual wood and paper requirements were estimated based on fiscal year 2004 purchasing data. This was done under the assumption that a cost-benefit analysis conducted on the scale of a single ream or board would not boast enough impact to warrant changes to Air Force purchasing regulations.

Unfortunately, the Air Force did not specifically track its wood and paper purchases and collecting data to calculate the *actual* quantities and cost of wood and paper purchased was impractical. For instance, in addition to the Air Force's contracting

officers and authorized representatives who utilized various contract vehicles to make purchases, in fiscal year 2004, there were over 46,000 Government Purchase Card (GPC) holders (Petering, 2004:3) that were potentially authorized to purchase wood and paper for the Air Force. And for the majority of wood and paper purchases, the total cost per order was likely under \$2,500, meaning the only *detailed* record of such purchases remained with the GPC cardholder in the form of a cash register receipt (AFI64-117 § 4.3.5.3.1.1, 2002). Such circumstances prohibited the expectation of 100 percent cooperation and data submission from Air Force employees who purchased paper or wood in fiscal year 2004. Instead, any data collected represented a minimum or conservative estimate and the actual quantities were noted as being higher.

### **3.2.2.1 Estimating the Air Force's Paper Requirement.**

For data concerning paper, the supplier that presumably filled most of the Air Force's paper requirement was surveyed. Federal agencies including the Air Force were required to satisfy requirements for supplies through the following sources listed in descending order of priority: 1) Agency inventories; 2) Excess from other agencies; 3) Federal Prison Industries, Inc.; 4) Supplies which are on the Procurement List maintained by the Committee for Purchase From People Who Are Blind or Severely Disabled (Javits-Wagner O'day (JWOD)); 5) Wholesale supply sources such as stock programs of the General Services Administration (GSA) and the Defense Logistics Agency (DLA); 6) Mandatory Federal Supply Schedules; 7) Optional use Federal Supply Schedules; and 8) Commercial sources (FAR § 8.002(a)). In fiscal year 2004, JWOD was the highest prioritized source that supplied paper for any federal agency assuming that agency inventories were exhausted. Further, paper was on the Procurement List maintained by

JWOD and once a product appeared on this list, agencies were required to purchase the product from the organization designated by JWOD, which in this case is the National Industries for the Blind (NIB)(Products List, 2004). Consequently, JWOD, the distributor of paper manufactured by the NIB, was assumed to be the source that met the majority of the Air Force's paper needs and was the sole source of information concerning paper purchases.

JWOD sold paper through five channels: JWOD.com, GSA schedules, Department of Defense Electronic Mall, over 50 Authorized Commercial Distributors, and Self Service Supply Stores (SERVMART). Unfortunately, collecting data specific to Air Force paper purchases from any channel other than the SERVMARTs was prohibited by the fact that these sources sold paper to the entire federal government and did not separate purchasing data by agency. Gathering data about paper purchased through these channels would have required a survey of every Air Force employee authorized to make purchases. As stated previously, such effort was considered unreasonable for the purposes of this study. The SERVMARTs, on the other hand, were actual storefronts located on many military installations and within several federal buildings. In fact, 46 of the 62 CONUS Air Force installations had SERVMARTs and were encouraged to purchase their NIB supplies from them. Due to the requirement to purchase paper manufactured by the NIB and the convenient location of the stores, it was assumed that the SERVMARTs filled the majority of the installations' paper requirements. For this reason, each of the 46 SERVMARTs located on Air Force installations was surveyed for information regarding the total quantity of paper sold in fiscal year 2004. Because it was likely that the Air Force was the majority customer if not the sole customer at these

SERVMARTs, the data collected provided a realistic estimate of the minimum quantity of paper sold to the Air Force in fiscal year 2004.

### **3.2.2.2 Estimating the Air Force's Wood Requirement.**

As with paper, the Air Force was required to satisfy its wood requirements through the same supply sources listed above in descending order of priority. However, for wood, GSA and DLA, represented the sources with highest priority. As such, GSA and DLA were contacted for Air Force purchasing data. Representatives from both organizations stated that although they did supply federal agencies with wood, the Air Force purchased very little. Even if the Air Force had purchased more, neither organization was willing or capable of identifying and isolating these orders. Both the DLA and GSA representatives also stated that the Air Force had its own contract vehicles for wood and that such contracts along with Government Purchase Card purchases probably filled most of the Air Forces wood requirements. Based on this information, the Air Force's three major types of contracts for wood were identified. They were the Simplified Acquisition of Base Engineering Requirements (SABER), Contractor Operated Civil Engineering Supply Store (COCESS), and Government Operated Civil Engineering Supply Store (GOCESS) contracts. Then each of the Air Force contracting offices was surveyed for data regarding wood purchases made in fiscal year 2004. The contracting offices were encouraged to gather this data from their SABER, COCESS, and GOCESS contracts and from any Government Purchase Card logs or other purchase orders. It was understood that such a request was burdensome to the contracting offices and that the process of pulling the information from individual purchase documents would be tedious. Thus, any responses from the contracting offices were assumed to

represent a minimum estimate of the amount of wood purchased and that the actual amount was higher.

### **3.2.2.3 Costs and Benefits of Acquiring Products.**

Market research was conducted to identify U.S. paper suppliers that offered 30% PCC paper, 100% PCC paper, or both; and U.S. wood suppliers that offered uncertified wood, FSC-certified wood, or both. Then prices from a portion of the identified suppliers were collected either from the suppliers' published price lists or through direct contact with the suppliers. A range and average of the prices collected were calculated and recorded.

Specifically for data concerning paper, the search for suppliers was limited to four of the five JWOD paper supply channels: JWOD.com, GSA, Department of Defense Electronic Mall, and the SERVMARTs. Many of the 50-plus JWOD Authorized Commercial Distributors sold paper through the other four channels and were not contacted for information directly. For data concerning both uncertified and FSC-certified wood, the search for suppliers began with GSA and DLA wood suppliers but was also extended to a search of the world-wide web.

### **3.2.2.4 Other Costs.**

Published literature from industrial, academic, governmental, and non-governmental sources was searched to identify differences in the costs of environmental and economic aspects and potential impacts of each baseline product compared to its environmentally preferable alternative. Differences included emission of pollutants, waste discharge, resource consumption, and non-use values like recreation and biodiversity. Differences to which monetary values could be assigned were incorporated

into the life cycle cost-benefit analysis calculations. Differences that could not be quantified or have monetary values assigned were reserved for use as offsets in the case that all costs associated with the baseline and alternative products were equal or close. For example, differences favorable to the environment were considered benefits and differences harmful to the environment were considered costs.

### **3.2.3 Step 4: Evaluate the Benefits and Costs.**

Since many of the benefits and costs, such as the recreational value of a conserved forest, would continue to be realized several years after the purchase of a product, the evaluation was accomplished by discounting the future values of such benefits and costs to find their present values (PV) in 2004 dollars. Basically, the *present values* represent what the benefits and costs to be received in the future would be worth in 2004 dollars. Thus, the present values represent the amount of money in 2004 dollars which, if invested at a particular interest rate, would grow to the amount of the future benefit or cost at that time in the future (Mathis, 2004). For this study, the time in the future was limited to five years or 2009. Such a short term was selected despite the lengthier life cycle potentials for both wood and paper because it was assumed the Air Force would prefer more immediate benefits or costs. The interest or discount rate was selected based on the U.S. Department of Treasury's (2005) 5-year constant maturity treasury rates for September 2004. The formula used to calculate PV is shown in Equation 3-1 (Mathis, 2004).

$$PV = \frac{CF_t}{(1+r)^t} \quad (3-1)$$

where

- PV = Present Value
- CF<sub>t</sub> = Future Cash Flow which occurs t years from now
- r = the discount rate
- t = the number of years

### 3.2.4 Step 5: Compare the Benefits and Costs.

The last step was the comparison of the benefits and costs using the net present value (NPV) technique. Simply, the Air Force should choose to purchase the product with the highest positive NPV. For example, if both products had equal performance and availability standards and the NPV of purchasing 100% PCC paper were higher than the NPV of purchasing 30% PCC paper, the recommendation would be that the Air Force changes its requirements to mandate the purchase of 100% PCC paper. By the same token, if the NPV of purchasing uncertified wood were higher than the NPV of purchasing certified wood, the recommendation would be that the Air Force leave its purchasing requirements for wood unchanged. The NPV calculation also incorporated the five-year term from 2004 to 2009 and the discount rate selected based on the U.S. Department of Treasury's (2005) 5-year constant maturity treasury rates for September 2004. The formula used to calculate NPV is shown in Equation 3-2 (Mathis, 2004).

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+r)^t} = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_T}{(1+r)^T} \quad (3-2)$$

where

- $CF_t$  = the cash flow at time  $t$  and
- $r$  = the discount rate.

### 3.3 Assessing Exemption Applicability: Failure to Meet Performance Standard

Once wood and paper suppliers were identified to assess the unreasonable price exemption, market research concerning the suppliers' products was conducted specifically to gather information relating to performance specifications. In the absence

of an Air Force paper standard, the U.S. Government Printing Office's JCP O-65, *Plain Copier, Xerographic, White and Colored* (1999) was chosen to be the standard. If 100% PCC paper met or exceeded this standard, the performance standard exemption was considered inapplicable. In the case of wood, performance standards depended on the intended use of the wood. To avoid complicating this research further, the performance standards or available grades of FSC-certified wood were compared to the available grades of uncertified wood. If FSC-certified wood was available in grades equal to or higher than uncertified wood, the performance standard exemption was considered inapplicable.

### **3.4 Assessing Exemption Applicability: Not Reasonably Available**

Once wood and paper suppliers were identified to assess the unreasonable price and performance standards exemptions, market research concerning these suppliers' products was conducted specifically for information relating to product delivery times. The JWOD paper suppliers' product delivery times were considered to be *reasonable*. If suppliers of 100% PCC paper offered delivery times equal to or faster than the JWOD suppliers, this exemption was considered inapplicable. Similarly, the DLA and GSA wood suppliers' product delivery times were considered to be reasonable. If suppliers of FSC-certified wood offered delivery times equal to or faster than the DLA and GSA suppliers, this exemption was considered inapplicable.

### **3.5 Interpreting the Results**

If the results showed that FSC-certified wood and 100% PCC paper were available at reasonable prices; met performance standards; and were reasonably available within a practical period of time, the recommendation that the Air Force change its purchasing regulations to require the exclusive use and purchase of FSC-certified wood and 100% PCC paper would be feasible.

## **4.0 Results**

### **4.1 Introduction**

The criteria for exempting the Air Force from purchasing paper with less than the required 30% PCC were used to determine if it would be feasible for the Air Force to require the exclusive use and purchase of FSC-certified wood and 100% PCC paper. If either FSC-certified wood or 100% PCC paper did not meet the same performance standards; were not as available and were not available at prices equal to or less than uncertified wood and 30% PCC paper respectively, it would not be feasible to require their purchase. The comparative results are provided below.

### **4.2 Paper**

The seventeen brand name papers listed in Table 4.1 were investigated in this study. The baseline paper brands represented the paper products that would satisfy the Air Force's fiscal year 2004 requirement to purchase paper with a minimum of 30% post consumer content (PCC) (FAR §11.303(b)). The alternative paper brands represented products that would exceed the Air Force's fiscal year 2004 requirement and satisfy the alternative requirement for the Air Force to purchase paper with 100% PCC. Market price and delivery information advertised on the U.S. General Services Administration's (GSA) Advantage website ([gsaadvantage.gov](http://gsaadvantage.gov)) and the Department of Defense (DoD) Electronic Mall (EMALL) website ([www.emall.dla.mil](http://www.emall.dla.mil)) were collected for each brand of

paper. In total 65 companies offered at least one of the paper brands under investigation—all 65 suppliers offered 30% PCC paper, 13 offered 100% PCC paper.

**Table 4.1 Baseline and Alternative Paper Brands (adapted from GPO, 2003)**

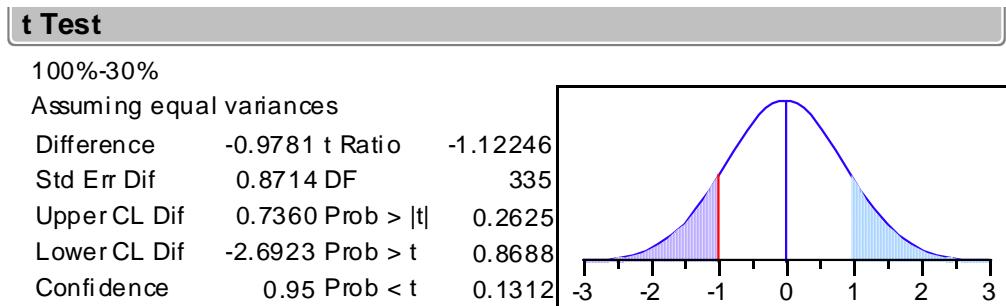
Brand Name	Post Consumer Content	Manufacturer
<b>BASELINE</b>		
Aspen Xerographic	30%	Boise Cascade Paper Group
Colorsource	30%	Unisource
Envirographic Bond/Offset	30%	Badger Paper Mills, Inc.
Eureka! 30% PC	30%	Georgia Pacific
GeoCycle	30%	Georgia Pacific
Great White MultiUse 20	30%	International Paper Co.
HP Office Recycled	30%	Hewlett Packard
Multi-Purpose Recycled Paper	30%	IBM
Recycled Husky Xerocopy DP	30%	Weyerhaeuser
Savings DP	30%	International Paper Co.
Skilcraft Xerographic Paper	30%	National Industries for the Blind
Willcopy Recycled Paper	30%	Williamette Industries, Inc.
Windsor Copy Recycled	30%	Domtar Papers, Inc.
Xerox Multipurpose Recycled Paper	30%	Xerox Corporation
<b>ALTERNATIVE</b>		
Encore 100	100%	New Leaf Paper
Envirographic 100 % PC	100%	Badger Paper Mills, Inc.
Eureka! 100% PC	100%	Georgia Pacific

#### **4.2.1 Assessing Exemption Applicability: Failure to Meet Performance Standard.**

Each brand of paper considered in this study was compliant with the U.S. Government Printing Office's (GPO) paper specification JCP O-65, *Plain Copier, Xerographic, White And Colored* (1999). This was confirmed by tests performed by the GPO's Quality Control and Inventory Management Department (GPO, 2003). Since the three brands of 100% PCC paper met the same performance specifications as the 14 brands of 30% PCC paper, no exemption from purchasing 100% PCC paper could be made based on the paper not meeting performance standards.

#### 4.2.2 Assessing Exemption Applicability: Not Reasonably Available.

The advertised delivery times for each brand of paper under investigation were collected from GSA Advantage and DoD EMALL. The delivery times suppliers offered for 30% PCC paper ranged from 1 to 30 days whereas the delivery times offered for 100% PCC paper ranged from 1 to 5 days. A t-test (JMP 5.1, 2003) was conducted comparing the delivery times for the 100% PCC paper brands against the delivery times of the 30% PCC paper brands. The t-test results shown in Figure 4.1 showed that there were no significant differences between the delivery times for the two paper types. Therefore, an exemption from purchasing 100% PCC paper based on the paper not being reasonably available could not be applied.



**Figure 4.1 T-test Comparison of Delivery Times Advertised for 30% and 100% PCC Paper**

#### 4.2.3 Assessing Exemption Applicability: Unreasonable Price.

Understanding the magnitude of the Air Force's paper requirement became a necessity for comparing the prices of paper due to the availability of quantity discounts from many of the GSA and EMALL suppliers. Paper was typically packaged 500 sheets per ream, 10 reams per case, and 40 cases per pallet. If quantity discounts were available,

they were generally available at the following breakpoints: 2, 120, 200, 440, and 800 cases.

Of the 46 Javits-Wagner O'day (JWOD) Self Service Supply Stores (SERVMART) surveyed for information regarding the total quantity of paper sold in fiscal year 2004, 23 responded. In total, the responsive SERVMARTs sold 55,699 cases of paper to the Air Force in fiscal year 2004. From this figure, it was calculated that each base required roughly 200 cases of paper per month, which as stated previously was an underestimate of the actual amount of paper consumed.

#### **4.2.3.1 Market Price of Paper.**

Rather than collecting price information from each of the SERVMARTs, advertised market prices for each brand of paper under investigation were collected from GSA Advantage and DoD EMALL. This was done for convenience although it was justifiable because JWOD, along with other suppliers, published prices on these sites. In total, there were 295 advertised prices for the 30% PCC paper brands and 42 prices for the 100% PCC paper brands. The sample sizes for prices were a result of the 65 paper suppliers holding multiple price schedules or offering quantity discounts for a single paper brand or both. For example, one supplier offered 3 different brands of paper; gave quantity discounts at three break points; and held 2 different pricing agreements with GSA—this supplier represented 24 data points. Six t-tests comparing the prices of the 100% PCC paper brands against the prices of the 30% PCC paper brands were run—one t-test per quantity discount breakpoint discussed above. The results are provided in Table 4.2 below. If paper were purchased in quantities between 2 and 119 or 200 and 439 cases, there were no significant differences between the prices of 100% PCC and 30%

PCC paper. At each of the other breakpoints, however, the prices of 100% PCC paper were significantly higher than the prices of 30% PCC paper, despite individual instances where the price of a 100% PCC paper brand was less than the price of a 30% PCC paper brand.

**Table 4.2 Paper Prices Based on Quantity Purchased**

Discount (Quantity of Cases)	Post-Consumer Content	Mean	Standard Deviation	Sample Size	Significant Price Difference?
No Discount Offered	100%	\$97.65	\$ 16.56	22	Yes
	30%	\$52.20	\$ 21.48	175	
2 - 119	100%	\$37.60	\$ 0.75	4	No
	30%	\$35.60	\$ 8.71	59	
120 - 199	100%	\$35.03	\$ 0.41	4	Yes
	30%	\$23.54	\$ 0.93	10	
200 - 439	100%	\$32.01	\$ 0.74	4	No
	30%	\$28.55	\$ 6.76	20	
440 - 799	100%	\$30.02	\$ 0.26	4	Yes
	30%	\$22.61	\$ 0.23	10	
> 800	100%	\$28.52	\$ 0.57	4	Yes
	30%	\$23.51	\$ 2.18	21	

#### **4.2.3.2 Other Costs.**

The White House Task Force on Waste Prevention and Recycling joined with the U.S. Postal Service, EPA, and Environmental Defense to create a web-based Paper Calculator® that among other things used average U.S. energy and wood consumption data and environmental release data to calculate differences between 30% PCC paper and 100% PCC paper (OFEE, 2004). The Paper Calculator's outputs reflected differences in the products' life cycles from production to recovery, disposal, or incineration (OFEE, 2004). Table 4.3 was adapted from the Paper Calculator's output for the comparison of one ton of 100% PCC paper to one ton of 30% PCC paper.

Altogether, when the life cycle of 100% PCC paper was compared to 30% PCC paper, it was found that less energy and wood were consumed, fewer pollutants were emitted, and less waste and effluent were discharged throughout the 100% PCC paper life cycle. Specifically, no new wood was used in the production of 100% PCC paper and 3,447 kWh or 35% less energy was consumed during this paper's life cycle. In terms of air pollutants, 29% fewer greenhouse gases, 17% fewer nitrogen oxides, 33% fewer particulates, 2% fewer sulfur oxides, 87% fewer hazardous air pollutants, 59% fewer volatile organic chemicals, and no total reduced sulfur were emitted throughout the life cycle of 100% PCC paper. Additionally, approximately 40% less solid waste was generated and 40% less effluent was discharged per ton during the 100% PCC paper life cycle. Lastly, the 100% PCC paper had a lesser impact on water quality—specifically, no adsorbable organic halogens and 24% fewer suspended solids were present in the water discharged and the biological and chemical oxygen demands were 62% and 24% better, respectively.

In only one respect was the life cycle of 100% PCC paper *worse* than the life cycle of 30% PCC paper—fossil fuel consumption. Throughout the life cycle of 100% PCC paper, 14% more fossil fuel derived energy was consumed. The Paper Calculator was based on research that looked at both total energy used (fossil fuel-derived energy, energy generated from bark and pulping liquors at pulp mills, and paper burned in incinerators) and fossil fuel-derived energy (purchased fossil fuels and purchased electricity) (Paper Task Force, 1995). The amount of fossil fuel-derived energy was specifically isolated because the use of fossil fuels has its own set of environmental impacts caused during extraction, refinement, and combustion (Paper Task Force, 1995).

Estimates of these impacts were included in the Paper Calculator's output (Paper Task Force, 1995).

**Table 4.3 Other Costs Associated with the Life Cycles of 30% PCC and 100% PCC Paper**

Consumption and Environmental Releases Associated with Paper Life Cycles (per ton of paper)	Post-Consumer Content (PCC)		Difference (100% PCC - 30% PCC)
	30%	100%	
<b>Energy Usage (kWh)</b>			
Total	9,795.40	6,347.45	-3,447.95
Fossil Fuel-Derived	4,394.25	5,007.94	613.69
<b>Atmospheric Emissions (ton)</b>			
Net Greenhouse Gases (CO <sub>2</sub> Equivalents)	2.5252	1.7911	-0.7342
Nitrogen Oxides	0.0087	0.0072	-0.0015
Particulates	0.0054	0.0037	-0.0018
Sulfur Oxides	0.0131	0.0128	-0.0003
Hazardous Air Pollutants (HAPs)	0.0008	0.0001	-0.0007
Volatile Organic Chemicals (VOCs)	0.0022	0.0009	-0.0013
Total Reduced Sulfur (TRS)	0.0001	0.0000	-0.0001
<b>Solid Wastes (ton)</b>	0.9559	0.5774	-0.3786
<b>Waterborne Wastes (ton)</b>			
Adsorbable Organic Halogens (AOX)	0.0006	0.0000	-0.0006
Biochemical Oxygen Demand (BOD)	0.0031	0.0031	-0.0001
Chemical Oxygen Demand (COD)	0.0363	0.0138	-0.0225
Suspended Solids	0.0046	0.0035	-0.0011
<b>Effluent Flow (gal)</b>	17461	10325	-7,136.21
<b>Wood (ton)</b>	2.4267	0.0000	-2.4267

Market prices were found for several of the consumables, wastes, and pollutants. For total energy, the U.S. Department of Energy's Energy Information Administration (EIA) published that the retail price of electricity sold to U.S. industries in October 2004 ranged from \$0.03 to \$0.10 per kilowatt hour (EIA, 2005). Since this price reflected energy derived from all sources including fossil fuels, no market price was sought for fossil fuel derived energy. For solid waste disposal, the national average tipping fee was found to be \$33.70 per ton (Repa, 2002). For wood consumed, the stumping price for pulp wood ranged from \$0.19 to \$32 per ton (Maine Forest Service, 2003; Georgia Pacific, 2005; and others).

Market prices were also found for some of the atmospheric pollutants.

Basically, utility and other major air emissions sources can purchase credits that permit them to emit a certain amount of individual air pollutants. Although there were no set prices for these credits, the prices varied considerably by location. In accordance with the Clean Air Act of 1970, the EPA developed National Ambient Air Quality Standards (NAAQS). Basically, the price for a permit was higher for facilities located in areas 1) with air quality that did not meet the NAAQS; 2) with poorer air quality; 3) with air quality standards higher than the NAAQS. Brokerage firms established a marketplace for the trading of emissions credits and the market prices collected for this research were reflect actual prices paid for credits. The market price for carbon (greenhouse gas CO<sub>2</sub> equivalents) ranged from \$1.74 to \$9.15 per ton of carbon (Pointcarbon, 2005; Chicago Climate Exchange, 2005; Cool Action, 2005; and Carbon Exchange, 2005). The market price for nitrogen oxides ranged from \$2,800 to \$3,900 per ton (Evolution Markets, 2005). Credits for the emission of particulate matter ranged from \$19,500 to \$45,000 per ton (Cantor, 2005). Sulfur oxide credits traded from \$128 to \$715 per ton (Evolution Markets, 2005). Volatile organic chemical emission permits sold from \$1,150 to \$65,000 per ton (Cantor, 2005). Again, prices varied by location which resulted in the large price ranges. For example, a particulate matter credit sold for \$19,500 in San Joaquin Valley, California while a credit sold for \$45,000 in San Diego, California.

The market prices for energy, wood, and environmental releases stated above were the extent of the *other costs* that were considered in the life cycle cost-benefit analysis comparing the two paper types. The reduced generation of hazardous air pollutants, total reduced sulfur, waterborne waste discharges, and effluent flows were

acknowledged as benefits to purchasing 100% PCC paper, but no sources assigning values to these pollutants were found. Also, since no new wood was harvested for the production of 100% PCC paper, it was acknowledged that in addition to the savings from not purchasing pulpwood, the values of trees or forests left standing were also benefits associated with 100% PCC paper. The literature was replete with studies that suggested people valued forests for a number of nonuse values, such as a forest's ability to store carbon, the biodiversity that it fosters, and even the knowledge that a forest exists.

Several studies have attempted to estimate the non-use value associated with forests by determining people's willingness to pay to avoid a potentially harmful situation for a particular forest. While the Air Force currently does not recognize benefits associated with capturing these values, the values still exist. Pearce (2001) identified forest non-use values derived from several studies that conservatively ranged from \$2 to \$20 per acre, depending on the specific situation and the associated negative effect. In addition to non-use values, forests provided value by acting as an "atmospheric scrubbers". "Much of the woody biomass of a tree is carbon; therefore, growing new trees fixes carbon over the lifetime of those trees" (Bateman, et al., 2003). Roughly one ton of carbon was stored per acre of forest (EPA, 2005). Using values previously calculated the value for afforestation from temperate forests ranged from \$36 to \$162 per acre. Inclusion of benefits such as those identified above would only serve to make a more compelling argument for the use of 100% PCC paper.

#### **4.2.4 Evaluate and Compare the Benefits and Costs.**

Some of the market prices found for the other costs associated with paper were given in other than fiscal year 2004 dollars. The present value (PV) in fiscal year 2004

dollars for all market prices collected were calculated using the formula shown in Equation 4-1. The U.S. Treasury's average 5-year constant maturity treasury rate (3.36%) for September 2004 was used as the interest rate (Department of Treasury, 2004).

$$PV = \frac{CF_t}{(1+r)^t} \quad (4-1)$$

where

PV = Present Value

CF<sub>t</sub> = Future Cash Flow which occurs t years from now

r = the interest or discount rate

t = the number of years

The calculated market prices in fiscal year 2004 dollars are provided in Table 4.4.

**Table 4.4 Market Price of Paper Life Cycle Costs in Fiscal Year 2004 Dollars**

Life Cycle Cost	Market Price (FY04 \$)	
	Low	High
<b>Energy Usage (kWh)</b>		
Total	\$ 0.03	\$ 0.10
<b>Atmospheric Emissions (ton)</b>		
Net Greenhouse Gases (CO <sub>2</sub> Equivalents)	\$ 1.68	\$ 8.85
Nitrogen Oxides	\$ 2,708.98	\$ 3,773.22
Particulates	\$ 20,155.20	\$ 46,512.00
Sulfur Oxides	\$ 123.84	\$ 691.76
Volatile Organic Chemicals (VOCs)	\$ 1,188.64	\$ 67,184.00
<b>Solid Wastes (ton)</b>	\$ 36.00	\$ 36.00
<b>Wood (ton)</b>	\$ 0.20	\$ 120.94

Next, the market prices were used to calculate the life cycle cost per ton of paper processed. The results are provided in Table 4.5. The other costs associated with 100% PCC paper were \$176 to \$1,494 per ton less than the other costs associated with 30% PCC paper. Acquisition and other costs combined, the total cost of one ton of 100% PCC

paper ranged from \$1,443 to \$5,978. The total cost of one ton of 30% PCC paper ranged from \$1,371 to \$8,762.

**Table 4.5 Life Cycle Cost Comparison of 100% PCC Paper to 30% PCC Paper  
in Fiscal Year 2004 Dollars**

Costs per ton of Paper Purchased	100% PCC		30% PCC	
	Low	High	Low	High
<b>Acquisition Costs</b>	\$ 1,107.60	\$ 5,004.00	\$ 860.00	\$ 6,932.00
<b>Other Costs</b>				
Total Energy Usage (kWh)	\$ 196.14	\$ 651.25	\$ 302.68	\$ 1,005.01
Net Greenhouse Gases (CO <sub>2</sub> Equivalents)	\$ 3.02	\$ 15.86	\$ 4.25	\$ 22.35
Nitrogen Oxides	\$ 19.50	\$ 27.17	\$ 23.49	\$ 32.71
Particulates	\$ 73.57	\$ 169.77	\$ 109.54	\$ 252.79
Sulfur Oxides	\$ 1.59	\$ 8.85	\$ 1.62	\$ 9.07
Volatile Organic Chemicals (VOCs)	\$ 1.07	\$ 60.47	\$ 2.61	\$ 147.47
Solid Wastes (ton)	\$ 20.78	\$ 20.78	\$ 34.41	\$ 34.41
Wood (ton)	\$ -	\$ -	\$ 0.48	\$ 293.47
<b>Subtotal Other Costs</b>	\$ 335.12	\$ 973.60	\$ 511.30	\$ 1,829.50
<b>Total Costs</b>	\$ 1,442.72	\$ 5,977.60	\$ 1,371.30	\$ 8,761.50

### 4.3 Wood

Since there was no requirement for the Air Force to purchase certified wood in fiscal year 2004, uncertified wood was the baseline wood product and FSC-certified wood was the alternative product. Of the 36 contracting offices surveyed for information regarding the quantity and price paid for wood, only seven responded with data while others responded that their wood purchases were made with Government Purchase Cards at local home improvement centers, e.g. The Home Depot and Lowes, rendering the data too difficult to track. From the data received, it was determined that in fiscal year 2004, the Air Force paid \$21,479 for over 30 million board feet of wood. This equated to 5,772 pieces of 2" x 4" x 8' wood at \$3.71 per piece.

In order to compare the availability, performance, and price of FSC-certified wood to uncertified wood, market research was conducted. The Home Depot, Lowes, and the 27 U.S. suppliers advertised by the FSC as being retailers of FSC-certified wood (Metafore, 2004) were asked to provide data concerning both FSC-certified wood and uncertified wood.

#### **4.3.1 Assessing Exemption Applicability: Failure to Meet Performance Standard.**

Data regarding the performance standard, or grade of wood purchased by the Air Force in fiscal year 2004 was unattainable so the grades of wood quoted by the surveyed wood suppliers were compared. The Home Depot and Lowes both carried only *kiln dried stud* grade wood at the time of the survey. However, it was also found that the grades of wood carried in such home improvements stores could vary by day and by store. For FSC-certified wood, two of the FSC-identified suppliers quoted three different grades: *kiln dried No. 2 or better, kiln dried standard or better, and green No. 2 or better*. Kiln dried wood, dried under controlled conditions, was considered to be better than green wood which is wetter and not dried under controlled conditions. *No. 2 or better* is a higher grade than *stud* which in turn is a higher grade than *standard or better*. All that said, FSC-certified wood met or exceeded the performance standards of non-certified wood, therefore, it would be unlikely that an exemption from purchasing FSC-certified wood could be made based on the wood not meeting performance standards.

#### **4.3.2 Assessing Exemption Applicability: Not Reasonably Available.**

Delivery times for the wood purchased by the Air Force in fiscal year 2004 were unavailable. The Home Depot and Lowes quoted that 1,000 board feet (MBF) of wood (or 188 pieces of 2" x 4" x 8' lumber) could be delivered on the day of purchase or the

next. Suppliers would not quote delivery times for FSC-certified wood because the times were dependent upon location and inventory levels. Since FSC-certified wood suppliers were located in only nine states: California, Louisiana, Minnesota, Mississippi, North Carolina, New Hampshire, Oregon, Washington, and Wisconsin (Metafore, 2004), it was assumed that transport time would increase the delivery time by two to five days. Further, only two of the 27 FSC-certified wood suppliers said they had FSC-certified wood in stock at the time they were surveyed. For this reason, a more realistic delivery time would include the time associated with placing and filling an order directly with a mill. Thus, at the time of this research, FSC-certified wood was determined to be not as available as uncertified wood and an exemption from buying FSC-certified wood due to unreasonable availability could be justified.

#### **4.3.3 Assessing Exemption Applicability: Unreasonable Price.**

##### **4.3.3.1 Market Price of Wood.**

Market research revealed that market prices for wood fluctuated on a weekly, if not daily, basis. For this reason, most wood suppliers did not advertise wood prices and had to be contacted for current pricing. Unfortunately, of the 29 suppliers contacted, only seven were capable of providing any of the information requested: four provided quotations as shown in Table 4.6; and three estimated the price premium for FSC-certified wood to be between 5% and 15%. Due to the lack of data available, no conclusions regarding the market price of wood were drawn.

**Table 4.6 Market Price of FSC-Certified and Uncertified Wood by Grade and Supplier**

<b>Grade</b>	<b>Market Price per 2" x 4" x 8' board</b>			
	<b>FSC-certified</b>	<b>Uncertified</b>	<b>Supplier</b>	
Green No. 2 or Better	\$ 3.53	\$ 2.89	Supplier 1	
Kiln Dried No. 2 or Better	\$ 4.28	\$ 3.35	Supplier 1	
Kiln Dried Standard or Better	\$ 2.66		Supplier 2	
Kiln Dried Stud		\$ 2.56	Home Improvement Center 1	
Kiln Dried Stud		\$ 2.59	Home Improvement Center 2	
Kiln Dried Stud	\$ 3.71		Air Force Average Price Paid FY 2004	

#### **4.3.3.2 Other Costs.**

Managers of FSC-certified forests must have adhered to the FSC's 10 Principles and 57 Criteria that address legal issues, indigenous rights, labor rights, multiple benefits, and environmental impacts surrounding forest management (FSCUS, 2005). The FSC claimed that its standards represented the "world's strongest system for guiding forest management toward sustainable outcomes" (FSCUS, 2005), but no studies have quantitatively confirmed this claim. Further, a study that examined the criteria and indicators used to evaluate sustainable forestry practices in general stated that ecological indicators were difficult to evaluate due to the limitations in theoretical understanding of ecosystem functions, and the lack of methods to practically measure complex ecological variables (Woodley, et al., 1999). Nevertheless, it was assumed that unlike uncertified forests, FSC-certified forests were managed in such a way as to maintain the environmental services that the forest provided. Additionally, it was assumed that the timber supply in an FSC-certified forest was indefinitely sustainable whereas the timber supply in uncertified forests would be exhausted at some point in time.

Although the additional value society received from the environmental services retained by FSC-certified management practices was not quantified, the assumption that environmental services did provide value to society was generally accepted. Private citizens, organizations, and even the government purchased conservation easements from private forest owners in order to ensure that forest owners maintained their forests in a sustainable manner. In fact, 76 countries that had responded to a survey said that they had: 1) increased private sector participation in forest ownership, utilization and management; and 2) adopted at least one market-based incentive to encourage sustainable forest management by the private sector (Landell-Mills and Ford, 1999). The reason for the market-based incentives was that the governments recognized that forests provided environmental values external to the traditional market values of forests and that the market-driven private sector would not account for such values and tend to overexploit the resources (Landell-Mills and Ford, 1999). According to Landell-Mills and Porras (2002), the most ambitious market-based incentive for sustainable forestry was the development of markets for forest environmental services, such as carbon sequestration, biodiversity conservation, watershed protection and landscape values because practical understanding of both the market and the environment was limited.

The U.S. Department of Agriculture's Forest Service ran a large conservation easement and fee-simple purchase program called the Forest Legacy Program (FLP). The FLP was established in the 1990 Farm Bill to protect environmentally important forest areas that were threatened by conversion to non-forest uses (Forest Service, 2003). Further, the FLP provided incentive to maintain working forests, protect biodiversity, conserve watershed functions, maintain recreation opportunities, and protect all these

benefits for future generations (Forest Service, 2003). Since the FLP first received federal funding in fiscal year 1992, close to \$279 million (\$132 million in federal funds) had been spent to protect over 600,000 acres of U.S. forest (Forest Service, 2003). With this information, it was logical to conclude that on average, an acre of forest land provided at least \$220 in environmental services (\$132 million / 600,000 acres).

While the average price for an acre of land purchased under the FLP program was \$220, the marginal cost of an additional acre of land purchased in fiscal year 2005 was expected to be considerably higher. Using \$220 allowed the establishment of a lower bound for the purposes of evaluation. Given that other information necessary to complete the cost-benefit analysis was unavailable, \$220 acted as a proxy to quantify how much the government had valued forest lands that were threatened with conversion over the life of the FLP program. Were other data more readily available, it was expected that using the marginal cost of new acreage purchased would lead to a higher governmental value.

#### **4.3.4 Evaluate and Compare the Benefits and Costs.**

There was insufficient data to conduct an objective life cycle cost-benefit analysis comparing the purchase of FSC-certified wood to the purchase of uncertified wood. Only eight market prices of wood were obtained and there was no quantifiable evidence that FSC-certified wood provided more value in terms of forest services than uncertified wood. It was acknowledged; however, that theoretically, there was some additional value in FSC-certified wood that was not found in uncertified wood so long as FSC-certified forests were managed more sustainably.

#### **4.4 Summary**

This research showed that compared to the 30% PCC paper the Air Force was required to purchase in fiscal year 2004, 100% PCC paper met performance standards and was reasonably available. There were also circumstances under which the price of 100% PCC paper was reasonable (equal to or less than the price of 30% PCC paper (HQ AFCEE, 2002). Further, it was found that the other costs associated with 100% PCC paper were \$176 to \$1,494 per ton less than the other costs associated with 30% PCC paper.

This research also found that FSC-certified wood met the same standards as uncertified wood, but was not as available as uncertified wood. Additionally, there was not enough data to compare the market prices or the other costs associated with the two types of wood.

## **5.0 Discussion**

### **5.1 Introduction**

The purpose of this research was to determine if it would be feasible for the Air Force to require the exclusive use and purchase of FSC-certified wood and 100% PCC paper. Seven main questions guided this research.

(1) What type of paper and wood products is the Air Force currently required to purchase?

(2) If the Air Force is required to purchase certain paper or wood products, how were the requirements determined and who was responsible for establishing and enforcing them? How can these requirements be changed?

(3) If the Air Force is required to purchase certain paper or wood products, is it complying with the requirements?

(4) How much paper and wood does the Air Force consume annually?

(5) What paper and wood products are currently available commercially and to what extent?

(6) What benefits could result from the U.S. Air Force's use of paper containing 100 percent post consumer materials and certified wood products?

(7) What is the cost to the U.S. Air Force for purchasing certified wood and paper containing 100 percent post consumer materials?

## 5.2 Research Results for Paper

In fiscal year 2004, “100 percent” of the paper purchased by the Air Force was required to contain a minimum of 30 percent post consumer materials (FAR 11.303 (a)). In the case that such paper was not reasonably available; did not meet performance standards; or was only available at an unreasonable price, paper containing a minimum of 20 percent post consumer materials was to be purchased (FAR 11.303 (b)). There were no provisions to monitor or enforce the requirements (EPA, 2004), so there was no way to determine if the Air Force complied with the regulations. Part 11.303 of the Federal Acquisition Regulation implements Section 505 of Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition* (1998). The substance behind the executive order dates back to the Resource Conservation and Recovery Act (RCRA) of 1976.

RCRA required all federal agencies to purchase paper containing the highest percentage of post consumer materials as possible (42 U.S.C. § 6962(a)) and charged the US Environmental Protection Agency’s (EPA) with providing a *recommendation* for the minimum post consumer content level (42 U.S.C § 6962 (e)(1)). The requirement to purchase paper containing a minimum of 30 percent post consumer materials was based on the EPA’s recommendation (E.O. 13101 § 402(c), 1998) and any change to the requirement would likely occur only if the EPA changed its recommendation. For the Air Force to require the purchase of 100% PCC paper, it would not be necessary for the EPA to change its recommendation. In fact, RCRA, the FAR, and the EPA all encourage or

require agencies to purchase paper that meets or *exceeds* the 30 percent post consumer material level, which 100 percent does.

It would be futile to require the Air Force to purchase paper with 30 or 100 percent post consumer materials if such paper were not reasonably available. Market research revealed that the commercial paper supply was virtually limitless. From large office product supply chains like Staples and Office Depot to small convenience stores, there were countless suppliers offering paper containing anywhere from zero to 100 percent post consumer materials. At least 65 paper suppliers had pricing agreements or contracts available to the Air Force through the General Services Administration (GSAadvantage) and the Department of Defense Electronic Mall (EMALL). Additionally, there were 46 Javits Wagner O'Day (JWOD) Self Service Supply Stores (SERVMART) conveniently located on Air Force installations from which the Air Force was assumed to have purchased the majority of its paper. Each of the 65 companies and 46 SERVMARTs offered paper with 30 percent post consumer materials and at least 13 of these suppliers offered 100% PCC paper. Most of the suppliers advertised that their maximum limit per single order was \$150,000 (approximately 21,000 to 66,000 reams depending on the price per ream). Combined, 23 Air Force bases purchased 556,993 reams of paper (roughly 2000 reams per base per month) from SERVMARTs in fiscal year 2004; therefore, both types of paper were considered to be reasonably available.

According to the market prices collected from GSA Advantage and DoD EMALL, 100% PCC paper prices ranged from \$2.77 to \$12.51 per ream and 30% PCC paper prices ranged from \$2.15 to \$17.33 per ream. The prices were dependent upon brand, supplier, and quantity purchased. Excluding the isolated instances where the price of

100% PCC paper was lower, the Air Force often faced price premiums for this paper. But from production to disposal or recovery for recycling, less energy and wood were consumed; fewer greenhouse gases, nitrogen oxides, particulate mater, sulfur oxides, hazardous air pollutants, volatile organic chemicals, and total reduced sulfur were emitted; and less solid waste, waterborne waste, and effluent was generated during the lifecycle of 100% PCC paper. By assigning monetary values to electricity, solid waste disposal, pulp wood, and air pollution credits based on actual prices paid for such things in the marketplace, the environmental costs to society were calculated to be between \$0.40 to \$3.70 more per ream for 30% PCC paper. Thus, when the price of 100% PCC paper was less than \$0.40 higher than 30% PCC paper, it would be feasible for the Air Force to purchase 100% PCC paper based on life cycle cost.

### **5.3 Research Results for Wood**

At the time of this research, there were no requirements for the Air Force to purchase FSC-certified wood. Data gathered for this effort showed that the Air Force purchased at least 30 million board feet of 2" x 4" framing lumber. This wood was readily available and in sufficient quantities from local home improvement stores like The Home Depot and Lowes. FSC-certified wood was not nearly as available as uncertified wood. In fact, only 2 of the 27 known suppliers of FSC-certified wood had any framing lumber in stock.

It was assumed that FSC-certified wood was harvested in such a manner that all forest services were retained. This meant that the environmental benefits of purchasing FSC-certified wood would be the retention of forest services such as soil retention, carbon

sequestration, water filtration, biodiversity habitat, and watershed protection. The preservation of these services according to 7 FSC-certified wood suppliers would come at an increased price of 5 to 15 percent.

#### **5.4 Limitations**

This thesis had several limitations. First, it was based on the notion that if necessary, the Air Force should be willing to pay a price premium for paper or wood if it would decrease the environmental cost to society. The Air Force was charged with being a steward of public funds and a steward of the environment, but traditional mindset regards these two positions as mutually exclusive unless the environmental alternative were the lowest priced option. It would be reasonable for the Air Force to pay a higher price for higher quality. But it would take a total change in economic mindset for the Air Force to knowingly pay a higher price for paper or wood when it would receive no direct increase in value. Why should an Air Force organization in New Jersey pay \$0.40 more per ream of paper so that less pollution is emitted at a paper factory in Georgia? Why should the Air Force care about the environmental impacts that occurred before the Air Force purchases the items (e.g., emission of air pollutants during the paper manufacturing process) and after the Air Force has disposed of them (e.g., the release of methane from the decomposition of paper in a landfill)?

Another important limitation to this research was the subjectivity of assigning monetary values to things for which there was no established price. This research used the market price method to base prices on actual purchases made in the marketplace, but

this was still subjective. For instance, U.S. industries, including the paper industries, traded greenhouse gas credits. Each credit sold basically allowed the purchaser to emit one additional ton of greenhouse gases and reduced the amount of greenhouse gases the seller was allowed to emit by one ton. Fewer greenhouse gases were emitted during the lifecycle of 100% PCC paper than during the lifecycle of 30% PCC paper. The price that greenhouse gas credits sold for was assigned as the monetary value of better air quality, but does this reflect the true value of air quality? Or does it reflect the price one paper manufacture is willing to pay to avoid air pollution fines or to avoid costly plant upgrades? In any case, the value of anything is based on personal or organizational perception. To reduce the impact of these discrepancies, this research examined the volume or quantity of purchases made in the marketplace and used the lowest and the highest prices in the lifecycle cost estimates. This way, a very conservative cost was calculated along with a maximum cost.

Still another limitation had to do with the FSC-certified versus uncertified wood comparison. There was insufficient data to conduct a life cycle cost benefit analysis. Not enough suppliers of FSC-certified wood could quote a price for the wood and price premium estimates for the wood ranged from 5% to 15%. Additionally, it was acknowledged that FSC-certification signifies sustainable forestry practices, but whether FSC-certified forests were more sustainable than uncertified forests could not be quantified. It could only be acknowledged that the environmental services provided by a forest had value. The existence of market-based incentives to preserve these environmental services indicated this value, but did not necessarily capture the true value because ecological indicators of sustainability were difficult to evaluate due to the

limitations in theoretical understanding of ecosystem functions, and the lack of methods to practically measure complex ecological variables (Woodley, et al., 1999).

## **5.5 Recommendations**

The results of this research lead to the conclusion that compared to the 30% PCC paper the Air Force was required to purchase in fiscal year 2004, 100% PCC paper met performance standards and was reasonably available. By the Air Force's definition, there were instances where the price of 100% PCC paper was reasonable (equal to or less than the price of 30% PCC paper (Air Force Guide to Green Purchasing, 2003), but most of the time it was not. When the price of 100% PCC paper was higher than 30% PCC paper, the price difference could be offset by the environmental costs associated with paper throughout its lifecycle. This study calculated that if 100% PCC paper cost less than \$0.40 more per ream than 30% PCC paper, the lifecycle cost of exclusively using 100% PCC paper may actually be lower. For these reasons, it was determined to be feasible for the Air Force to require the exclusive use and purchase of 100% PCC paper. In the event that 100% PCC paper were no longer reasonably available or reasonably priced, a written justification for an exemption from the requirement could be used to allow for the purchase of paper containing fewer post consumer materials.

This research also concluded that it would not be feasible for the Air Force to require the exclusive use and purchase of FSC-certified wood. This was due to the fact that such wood was not available in sufficient quantities and the benefits of FSC-certified wood over uncertified wood still need to be determined.

## **5.6 Future Research**

Throughout this research effort, there was a need for a single catalogue of environmental services and their associated values, but no such thing existed. Instead, the researcher had to conduct mini-research efforts: first to catalogue what services or benefits a forest provides; second, to quantify each benefit; and third, to determine each service's worth. This was too much for a single study because the benefits of U.S.-wide environmental services were of interest, but most published literature provided values only for very site-specific ecosystems. If life cycle cost-benefit analyses are to be used in future purchasing decision, the effort required to research all the costs and benefits would be too cumbersome for an acquisition team and would likely avoid the evaluation of environmental costs altogether.

It would be very valuable for individual research efforts to be conducted for each ecosystem. For instance, one study should search literature and list all of the environmental services provided by a forest; a second study should list all of the environmental services provided by a lake; and so on. Next, a third study should quantify the environmental services provided by a forest. A fourth study should assign monetary values to the environmental services provided by a forest. And lastly, an effort should be made to put the results of all the former studies into one database. If this database contained a range of monetary values for various environmental services based on peer-reviewed literature, the Air Force would have a very valuable tool at its disposal. Additionally, if the Air Force did try to quantify the benefits of the environment and

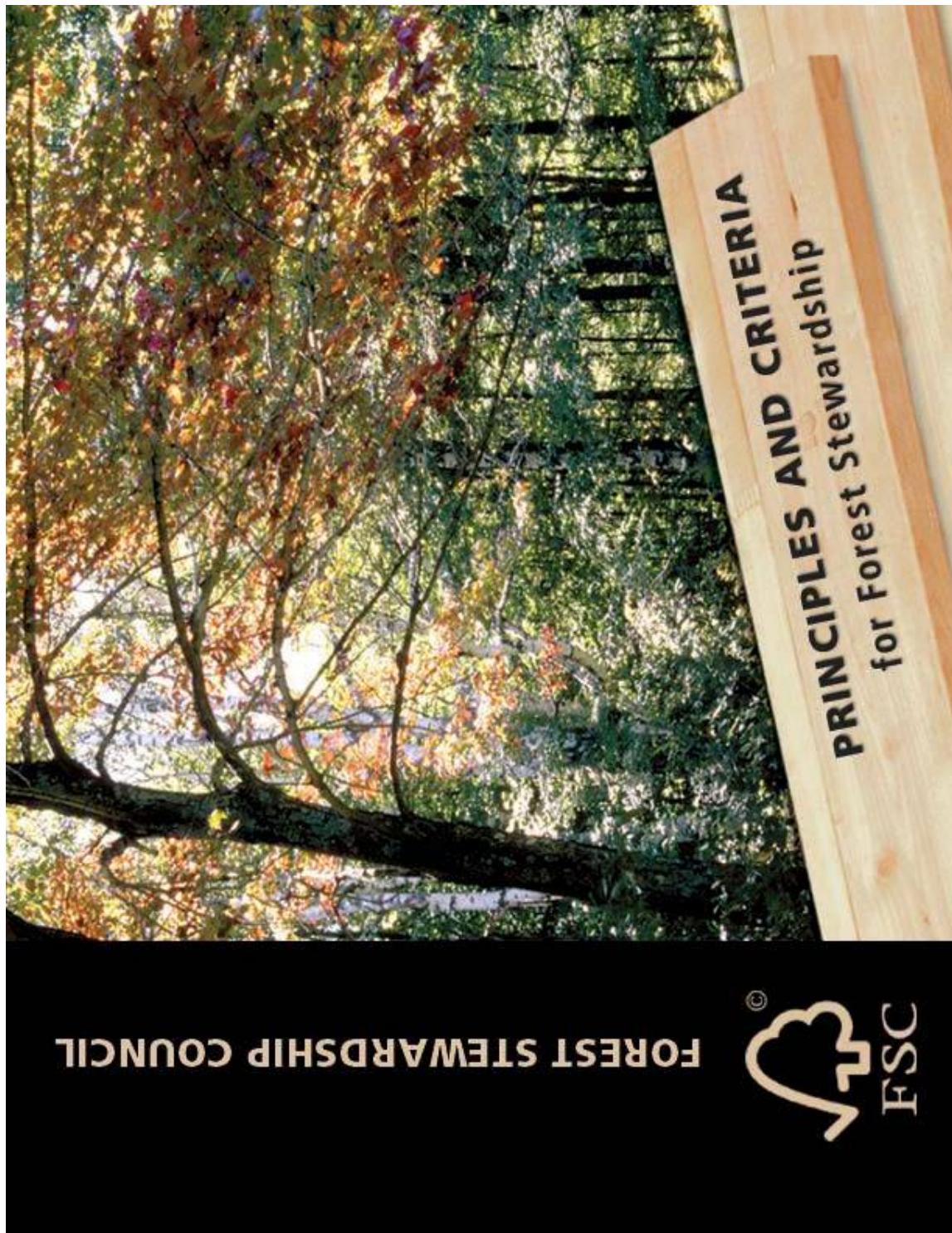
advertised their efforts, the Air Force's public image could be enhanced by its concern, or at least acceptance of the fact that the environment has value.

## **5.7 Closing Comments**

High profile acquisitions often garner some sort of environmental impact analysis. These analyses make the Air Force aware of potential environmental issues and force the Air Force to make decisions with this knowledge. For small profile acquisitions of commodities like paper and wood, environmental impact analyses are not required. In fact, the people making the purchases are likely unaware of any environmental consequences. Why should anyone care about the impacts of a \$2 ream of paper? In 1976, the writers of the Resource Conservation and Recovery Act realized that the government should care because in total, low-dollar commodity purchases do have a significant impact on the environment. The researcher hoped to quantify some of the environmental impacts associated with the purchase paper and wood. With this information, the Air Force can understand the differences between the products it currently purchases and the environmentally preferable alternatives that are available in the marketplace. This way the Air Force can decide if the protection of the environment is worth paying for.

## Appendix A

### Forest Stewardship Council Principles and Criteria for Forest Stewardship



FOREST STEWARDSHIP COUNCIL



# PRINCIPLES AND CRITERIA for Forest Stewardship

Revised Version: February 2000

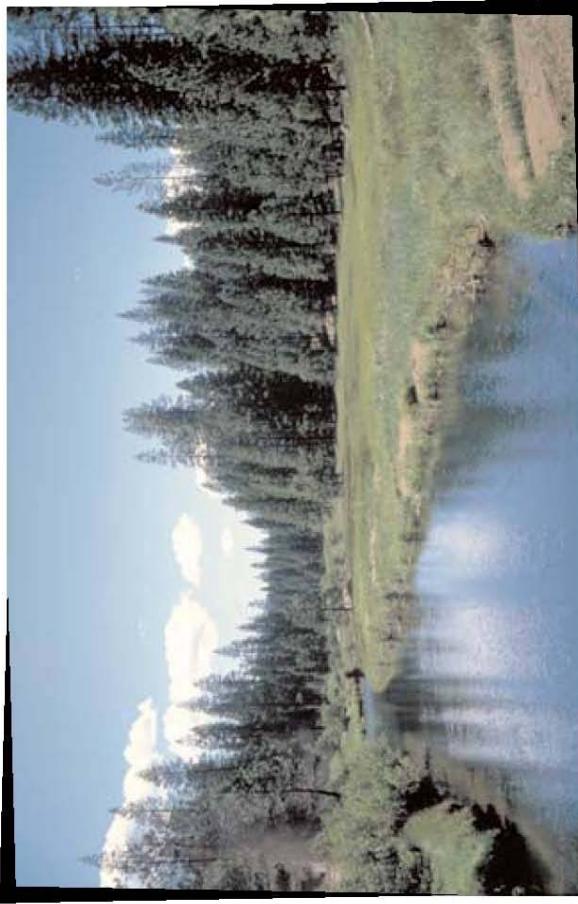
## INTRODUCTION

It is widely accepted that forest resources and associated lands should be managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. Furthermore, growing public awareness of forest destruction and degradation has led consumers to demand that their purchases of wood and other forest products will not contribute to this destruction but rather help to secure forest resources for the future. In response to these demands, certification and self-certification programs of wood products have proliferated in the marketplace.

The Forest Stewardship Council (FSC) is an international body which accredits certification organizations in order to guarantee the authenticity of their claims. In all cases the process of certification will be initiated voluntarily by forest owners and managers who request the services of a certification organization. The goal of the FSC is to promote environmentally responsible, socially beneficial and economically viable management of the world's forests, by establishing a worldwide standard of recognized and respected Principles of Forest Stewardship.

The FSC's Principles and Criteria (P&C) apply to all tropical, temperate and boreal forests, as addressed in Principle #9 and the accompanying glossary. Many of these P&C apply also to plantations and partially replanted forests. More detailed standards for these and other vegetation types may be prepared at national and local levels. The P&C are to be incorporated into the evaluation systems and standards of all certification organizations seeking accreditation by the FSC. While the P&C are mainly designed for forests managed for the production of wood products, they are also relevant to varying degrees, to forests managed for non-timber products and other services. The P&C are a complete package to be considered as a whole, and their sequence does not represent an ordering of priority. This document shall be used in conjunction with the FSC's Statutes, Procedures for Accreditation and Guidelines for Certifiers.

FSC and FSC-accredited certification organizations will not insist on perfection in satisfying the P&C. However, major failures in any individual Principles will normally disqualify a candidate from certification, or will lead to decertification.



the certification and accreditation process is included in the FSC Statutes, Accreditation Procedures, and Guidelines for Certifiers. The FSC P&C should be used in conjunction with national and international laws and regulations. FSC intends to complement, not supplant, other initiatives that support responsible forest management worldwide.

The FSC will conduct educational activities to increase public awareness of the importance of the following: 1) improving forest management; 2) incorporating the full costs of management and production into the price of forest products; 3) promoting the highest and best use of forest resources; 4) reducing damage and waste; and 5) avoiding over-consumption and over-harvesting. FSC will also provide guidance to policy makers on these issues, including improving forest management legislation and policies.

The FSC Founding Members and Board of Directors ratified Principles 1-9 in September 1994. The FSC Members and Board of Directors ratified Principle 10 in February 1996. The revision of Principle 9 and the addition of Criteria 6, 10 and 10.9 were ratified by the FSC Members and Board of Directors in January 1999. The definition of Precautionary Approach was ratified during the 1999 FSC General Assembly in June 1999.



## PRINCIPLE 1

### COMPLIANCE WITH LAWS AND FSC PRINCIPLES —

Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

1.1 Forest management shall respect all national and local laws and administrative requirements.

1.2 All applicable and legally prescribed fees, royalties, taxes and other charges shall be paid.

1.3 In signatory countries, the provisions of all binding international agreements such as CITES, ILO Conventions, ITTA, and Convention on Biological Diversity, shall be respected.

1.4 Conflicts between laws, regulations and the FSC Principles and Criteria shall be evaluated for the purposes of certification, on a case by case basis, by the certifiers and the involved or affected parties.

1.5 Forest management areas should be protected from illegal harvesting, settlement and other unauthorized activities.

1.6 Forest managers shall demonstrate a long-term commitment to adhere to the FSC Principles and Criteria.

## PRINCIPLE 2

### TENURE AND USE RIGHTS AND RESPONSIBILITIES —

Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

2.1 Clear evidence of long-term forest use rights to the land (e.g. land title, customary rights, or lease agreements) shall be demonstrated.

2.2 Local communities with legal or customary tenure or use rights shall maintain control, to the extent necessary to protect their rights or resources, over forest operations unless they delegate control with free and informed consent to other agencies.

2.3 Appropriate mechanisms shall be employed to resolve disputes over tenure claims and use rights. The circumstances and status of any outstanding disputes will be explicitly considered in the certification evaluation. Disputes of substantial magnitude involving a significant number of interests will normally disqualify an operation from being certified.

2.4 Forest management areas should be protected from illegal harvesting, settlement and other unauthorized activities.

## PRINCIPLE 3

### INDIGENOUS PEOPLE'S RIGHTS —

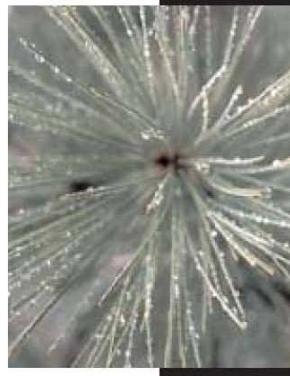
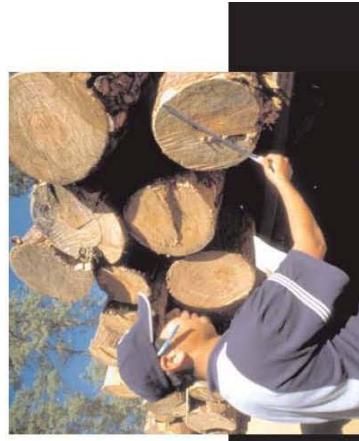
The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.

3.1 Indigenous peoples shall control forest management on their lands and territories unless they delegate control with free and informed consent to other agencies.

3.2 Forest management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples.

3.3 Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers.

3.4 Indigenous peoples shall be compensated for the application of their traditional knowledge regarding the use of forest species or management systems in forest operations. This compensation shall be formally agreed upon with their free and informed consent before forest operations commence.





## PRINCIPLE 4

### COMMUNITY RELATIONS AND WORKER'S RIGHTS —

Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

- 4.1 The communities within, or adjacent to, the forest management area should be given opportunities for employment, training, and other services.
- 4.2 Forest management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families.
- 4.3 The rights of workers to organize and voluntarily negotiate with their employers shall be guaranteed as outlined in Conventions 37 and 98 of the International Labour Organization (ILO).
- 4.4 Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups directly affected by management operations.
- 4.5 Appropriate mechanisms shall be employed for resolving grievances and for providing fair compensation in the case of loss or damage affecting the legal or customary rights, property resources, or livelihoods of local peoples. Measures shall be taken to avoid such loss or damage.

## PRINCIPLE 5

### BENEFITS FROM THE FOREST —

Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

- 5.1 The rate of harvest of forest products shall not exceed levels which can be permanently sustained.



## PRINCIPLE 6

### ENVIRONMENTAL IMPACT

Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.



6.1	Assessment of environmental impacts shall be completed—appropriate to the scale, intensity of forest management and the uniqueness of the affected resources—and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.	6.3	Ecological functions and values shall be maintained intact, enhanced, or restored, including: a) Forest regeneration and succession. b) Genetic, species, and ecosystem diversity. c) Natural cycles that affect the productivity of the forest ecosystem.	6.8	Use of biological control agents shall be documented, minimized, monitored and strictly controlled in accordance with national laws and internationally accepted scientific protocols. Use of genetically modified organisms shall be prohibited.
6.2	Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.	6.4	Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.	6.9	The use of exotic species shall be carefully controlled and actively monitored to avoid adverse ecological impacts.
6.5	Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources.	6.6	Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides. World Health Organization Type I A and I B and chlorinated hydrocarbon pesticides, pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use, as well as any pesticides banned by international agreement, shall be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks.	6.10	Forest conversion to plantations or non-forest land uses shall not occur, except in circumstances where conversion: a) entails a very limited portion of the forest management unit; and b) does not occur on high conservation value forest areas; and c) will enable clear, substantial, additional, secure long term conservation benefits across the forest management unit.
6.7	Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations.				



## PRINCIPLE 7

### MANAGEMENT PLAN

A management plan—appropriate to the scale and intensity of the operations—shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

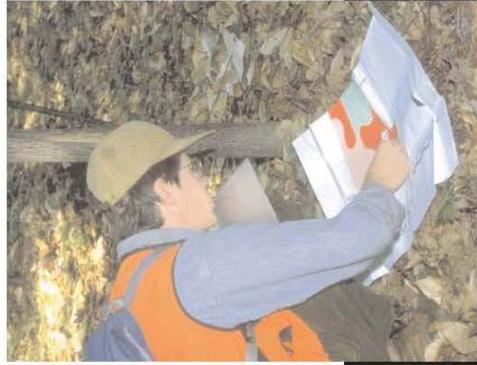
7.1 The management plan and supporting documents shall provide:

- Management objectives.
- Description of the forest resources to be managed, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.
- Description of silvicultural and/or other management system, based on the ecology of the forest in question and information gathered through resource inventories.

7.2 The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.

7.3 Forest workers shall receive adequate training and supervision to ensure proper implementation of the management plan.

7.4 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the primary elements of the management plan, including those listed in Criterion 7.1.



## PRINCIPLE 8

### MONITORING AND ASSESSMENT

Monitoring shall be conducted—appropriate to the scale and intensity of forest management—to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

8.1 The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the relative complexity and fragility of the affected environment. Monitoring procedures should be consistent and replicable over time to allow comparison of results and assessment of change.

8.2 Forest management should include the research and data collection needed to monitor, at a minimum, the following indicatrics:

- a) Yield of all forest products harvested.
- b) Growth rates, regeneration and condition of the forest.
- c) Composition and observed changes in the flora and fauna.
- d) Environmental and social impacts of harvesting and other operations.
- e) Costs, productivity, and efficiency of forest management.

8.3 Documentation shall be provided by the forest manager to enable monitoring and certifying organizations to trace each forest product from its origin, a process known as the "chain of custody."



8.4 The results of monitoring shall be incorporated into the implementation and revision of the management plan.

8.5 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the results of monitoring indicators, including those listed in Criterion 8.2.

## PRINCIPLE 9

### MAINTENANCE OF HIGH CONSERVATION VALUE FORESTS

Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

- 9.1 Assessment to determine the presence of the attributes consistent with High Conservation Value Forests will be completed, appropriate to scale and intensity of forest management.
- 9.2 The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof.
- 9.3 The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary.
- 9.4 Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes.



## PRINCIPLE 10

### PLANTATIONS

Plantations shall be planned and managed in accordance with Principles and Criteria 1 - 9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

10.1 The management objectives of the plantation, including natural forest conservation and restoration objectives, shall be explicitly stated in the management plan, and clearly demonstrated in the implementation of the plan.

10.2 The design and layout of plantations should promote the protection, restoration and conservation of natural forests, and not increase pressures on natural forests. Wildlife corridors, streamside zones and a mosaic of stands of different ages and rotation periods, shall be used in the layout of the plantation, consistent with the scale of the operation. The scale and layout of plantation blocks shall be consistent with the patterns of forest stands found within the natural landscape.

10.3 Diversity in the composition of plantations is preferred, so as to enhance economic, ecological and social stability. Such diversity may include the size and spatial distribution of management units within the landscape, number and genetic composition of species, age classes and structures.

10.4 The selection of species for planting shall be based on their overall suitability for the site and their appropriateness to the management objectives. In order to enhance the conservation of biological diversity, native species are preferred over exotic species. In the establishment of plantations, and the restoration of degraded ecosystems, Exotic species, which shall be used only when their performance is greater than that of native species, shall be carefully monitored to detect unusual mortality, disease, or insect outbreaks and adverse ecological impacts.

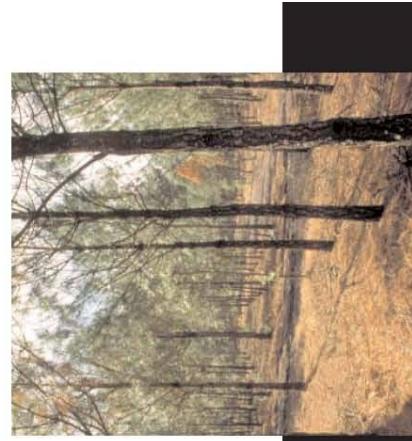
10.5 A proportion of the overall forest management area, appropriate to the scale of the plantation and to be determined in regional standards, shall be managed so as to restore the site to a natural forest cover.

10.6 Measures shall be taken to maintain or improve soil structure, fertility, and biological activity. The techniques and rate of harvesting, road and trail construction and maintenance, and the choice of species shall not result in long term soil degradation or adverse impacts on water quality, quantity or substantial deviation from stream course drainage patterns.

10.7 Measures shall be taken to prevent and minimize outbreaks of pests, diseases, fire and invasive plant introductions. Integrated pest management shall form an essential part of the management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides and fertilizers. Plantation management should make every effort to move away from chemical pesticides and fertilizers, including their use in nurseries. The use of chemicals is also covered in Criteria 6.6 and 6.7.

10.8 Appropriate to the scale and diversity of the operation, monitoring of plantations shall include regular assessment of potential on-site and off-site ecological and social impacts, (e.g. natural regeneration, effects on water resources and soil fertility, and impacts on local welfare and social well-being), in addition to those elements addressed in principles 8, 6 and 4. No species should be planted on a large scale until local trials and/or experience have shown that they are ecologically well-adapted to the site, are not invasive, and do not have significant negative ecological impacts on other ecosystems. Special attention will be paid to social issues of land acquisition for plantations, especially the protection of local rights of ownership, use, or access.

10.9 Plantations established in areas converted from natural forests after November 1994 normally shall not qualify for certification. Certification may be allowed in circumstances where sufficient evidence is submitted to the certification body that the manager/owner is not responsible directly or indirectly of such conversion.



## GLOSSARY

Words in this document are used as defined in most standard English language dictionaries. The precise meaning and local interpretation of certain phrases (such as local communities) should be decided in the local context by forest managers and certifiers. In this document, the words below are understood as follows:

Biological diversity	The variability among living organisms from all sources including, <i>inter alia</i> , terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. (See Convention on Biological Diversity, 1992)
Biological control agents	Living organisms used to eliminate or regulate the population of other living organisms.
Chain of custody	The channel through which products are distributed from their origin in the forest to their end-use.
Chemicals	The range of fertilizers, insecticides, fungicides, and hormones which are used in forest management.
Criterion (p) Criteria	A means of judging whether or not a Principle (of Forest Management) has been fulfilled.
Customary rights	Rights which result from a long series of habitual or customary actions, constantly repeated, which have, by such repetition and by uninterrupted acquiescence, acquired the force of a law within a geographical or sociological unit.
Ecosystem	A community of all plants and animals and their physical environment, functioning together as an interdependent unit.
Endangered species	Any species which is in danger of extinction throughout all or a significant portion of its range.
Exotic species	An introduced species not native or endemic to the area in question.
Forest integrity	The composition, dynamics, functions and structural attributes of a natural forest.
Forest management/ manager	The people responsible for the operational management of the forest resource, and of the enterprise, as well as the management system and structure, and the planning and field operations.
Genetically modified	Biological organisms which have been induced by various means to organisms consist of genetic structural changes.
High Conservation	High Conservation Value Forests are those that possess one or more of the following attributes:
	a) forest areas containing globally, regionally or nationally significant:
	i) concentrations of biodiversity values (e.g. endemism, endangered species, refugia), and/or
	ii) large landscape level forests, contained within, or containing the management unit, where viable populations of most, if not all naturally occurring species exist in natural patterns of distribution and abundance.
	b) forest areas that are in, or contain rare, threatened or endangered ecosystems
	c) forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control)
	d) forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health) and/or critical to local communities' traditional cultural identity (areas of ecological, economic or religious significance identified in cooperation with such local communities).
Indigenous lands and territories	The total environment of the lands, air, water, sea, ice, flora and fauna, and other resources which indigenous peoples have traditionally owned or otherwise occupied or used. (Draft Declaration of the Rights of Indigenous Peoples: Part VI)
Indigenous peoples	The existing descendants of the peoples who inhabited the present territory of a country wholly or partially at the time when persons of a different culture or ethnic origin arrived there from other parts of the world, overcame them and, by conquest, settlement, or other means reduced them to a non-dominant or colonial situation; who today live more in conformity with their particular social, economic and cultural customs and traditions than with the institutions of the country of which they now form a part, under State structure which incorporates mainly the national, social and cultural characteristics of other segments of the population which are predominant. (Working definition adopted by the UN Working Group on Indigenous Peoples).
Landscape	A geographical mosaic composed of interacting ecosystems resulting from the influence of geological, topographical, soil, climactic, biotic and human interactions in a given area.



Local laws	Includes all legal norms given by organisms of government whose jurisdiction is less than the national level, such as departmental, municipal and customary norms.	Nontimber forest	All forest products except timber, including other materials obtained from trees such as resins and leaves, as well as any other plant and animal products.
Long term	The time-scale of the forest owner or manager as manifested by the objectives of the management plan, the rate of harvesting, and the commitment to maintain permanent forest cover. The length of time involved will vary according to the context and ecological conditions, and will be a function of how long it takes a given ecosystem to recover its natural structure and composition following harvesting or disturbance, or to produce mature or primary conditions.	Other forest types	Forest areas that do not fit the criteria for plantation or natural forests and which are defined more specifically by FSC approved national and regional standards of forest management.
Native species	A species that occurs naturally in the region, endemic to the area.	Plantation	Forest areas lacking most of the principal characteristics and key elements of native ecosystems as defined by FSC approved national and regional standards of forest stewardship, which result from the human activities of either planting, sowing or intensive silvicultural treatments.
Natural cycles	Nutrient and mineral cycling as a result of interactions between soils, water, plants, and animals in forest environments that affect the ecological productivity of a given site.	Principle	Tool for the implementation of precautionary principle.
Natural forest	Forest areas where most of the principal characteristics and key elements of native ecosystems such as complexity, structure and diversity are present, as defined by FSC approved national and regional standards of forest management.	Silviculture	An essential rule or element, in the FSC's case, of forest management.
		Succession	The art of producing and tending a forest by manipulating its establishment, composition and growth to best fulfill the objectives of the owner. This may or may not include timber production.
		Tenure	Progressive changes in species composition and forest community structure caused by natural processes (nonhuman) over time.
			Socially defining agreements held by individuals or groups, recognized by legal statutes or customary practice, regarding the "bundle of rights and duties" of ownership, holding, access and/or usage of a particular land unit or the associated resources there within (such as individual trees, plant species, water, minerals, etc.)
			Any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
			Rights for the use of forest resources that can be defined by local custom, mutual agreements, or prescribed by other entities holding access rights. These rights may restrict the use of particular resources to specific levels of consumption or particular harvesting techniques.



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## BIBLIOGRAPHY

Bateman, Ian and others. *Applied Environmental Economics: A GIS Approach to Cost-Benefit Analysis*. Cambridge, UK: Cambridge University Press, 2003.

Bishop, Joshua T. *The Economics of Non-Timber Forest Benefits: An Overview*. International Institute for Environment and Development: Environmental Economics Programme, London, 1998

Bryant, Dirk, Nielson Daniel, and Laura Tangley. *The Last Frontier Forests: Ecosystems & Economies on the Edge*. Washington, D.C.: World Resources Institute, 1997.

Burman, Allan V. Administrator, Office of Federal Procurement Policy. "Procurement of Environmentally-Sound and Energy-Efficient Products and Services." Letter 92-4. 2 November 1992

Cantor Environmental Brokerage. *Market price index 2003*. 5 February 2005  
[http://www.emissionstrading.com/index\\_mpi.htm](http://www.emissionstrading.com/index_mpi.htm)

Chicago Climate Exchange. *CCX carbon market report*. 2(2). 5 February 2005  
[http://www.chicagoclimatex.com/news/newsletters/CCX\\_carbonmkt\\_feb05.pdf](http://www.chicagoclimatex.com/news/newsletters/CCX_carbonmkt_feb05.pdf)

Defense Acquisition University (DAU). *Market research course*. 4 May 2004  
<http://clc.dau.mil/>

Maine Forest Service. *2003 Stumpage prices by Maine county*. 5 February 2005  
<http://www.state.me.us/doc/mfs/pubs.htm>

Forest Service (2003). *Forest Legacy Program overview*. 8 January 2005  
[http://www.fs.fed.us/spf/coop/library/legacy\\_overview.pdf](http://www.fs.fed.us/spf/coop/library/legacy_overview.pdf)

Department of Defense (DoD). (2004). *Department of Defense green procurement strategy*. 27 October 2004 <https://www.denix.osd.mil/denix/Public/ES-programs/Pollution/Procurement/GPP/gpp-intro.html>

Department of the Air Force. *Air Force Government-Wide Purchase Card (GPC) Program*. AFI 64-117. Washington: HQ USAF, 6 December 2002.

Department of Treasury (2004, September). *Daily Treasury yield curve rates*. 2 march 2005 <http://www.ustreas.gov/offices/domestic-finance/debt-management/interest-rate/yield20040901.html>

Dixon, John A. and others. *Economic Analysis of Environmental Impacts*. London: Earthscan Publications Ltd, 1994.

Energy Administration. *Average retail price of electricity to ultimate customers by end-use sector, by state, October 2004 and 2003.* 4 January 2005 [http://www.eia.doe.gov/cneaf/electricity/epm/table5\\_6\\_a.html](http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html)

Environmental Protection Agency. *Final Guidance on Environmentally Preferable Purchasing for Executive Agencies.* Federal Register. 64 (161), 45816-45825. Washington: GPO, 20 August 1999.

Environmental Protection Agency. (2004). Comprehensive Procurement Guideline IV for Procurement of Products Containing Recovered Materials. *Federal Register*, 69(84), 24028-24038.

Environmental Protection Agency. *Carbon sequestration in agriculture and forestry.* 2 March 2005 <http://www.epa.gov/sequestration/faq.html>

Evolution Markets, LLC. *Monthly market update: NO<sub>x</sub> markets.* 15 January 2005 [http://www.evomarkets.com/assets/mmu/mmu\\_nox\\_feb\\_05.pdf](http://www.evomarkets.com/assets/mmu/mmu_nox_feb_05.pdf)

Evolution Markets, LLC. *Monthly market update: SO<sub>2</sub> markets.* 15 January 2005 [http://www.evomarkets.com/assets/mmu/mmu\\_so2\\_feb\\_05.pdf](http://www.evomarkets.com/assets/mmu/mmu_so2_feb_05.pdf)

Farber, S.C., Costanza, R., and M.A. Wilson. "Economic and Ecological Concepts for Valuing Ecosystem Services" 2002 *Ecological Economics* 41:375-392.

Forest Service. (2000). *U.S. Forest Facts and Historical Trends.* 2 June 2004 <http://fia.fs.fed.us/library/ForestFactsMetric.pdf>.

Forest Stewardship Council United States. *The history of FSC-US.* 2 March 2005 [http://www.fscus.org/about\\_us/](http://www.fscus.org/about_us/)

Forest Stewardship Council United States. *Principles and criteria for forest stewardship.* 6 June 2004 [http://www.fscus.org/images/documents/ FSC\\_Principles\\_Criteria.pdf](http://www.fscus.org/images/documents/ FSC_Principles_Criteria.pdf)

Georgia Pacific. *Timber prices.* 5 January 2005 <http://www.gp.com/forestry/timberprices.html>

Government Printing Office (GPO). (1999, February). *Government paper specification standards.* (11). 12 September 2004 <http://www.gpo.gov/acquisition/paperspecs.htm>

Government Printing Office (2003, July 30). *PC-content xerographic paper.* 12 September 2004 <http://www.access.gpo.gov/qualitycontrol/cpypaper.html>

Headquarters Air Force Center for Environmental Excellence (HQ AFCEE). (2002). *Guide to green purchasing: the Air Force Affirmative Procurement Program.* 27 October 2004 <http://www.afcee.brooks.af.mil/eq/ap/gg/chap2frame.htm>

Hufschmidt, Maynard M. and others. *Environment, Natural Systems, and Development: An Economic Valuation Guide*. Baltimore: The Johns Hopkins University Press, 1983.

Kengen, Sebastião (1997). Linking forest valuation and the financing. *Unasylva*, 48(188). 12 December 2004 [http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/docrep/w3247E/w3247E00.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/w3247E/w3247E00.htm)

King, Dennis M. and Marisa Mazzotta. *Ecosystem Valuation*. 16 October 2004 [http://www.ecosystemvaluation.org/hedonic\\_pricing.htm](http://www.ecosystemvaluation.org/hedonic_pricing.htm)

Landell-Mills, Natasha and Jason Ford. (1999, May). *Privatising Sustainable Forestry: A Global Review of Trends and Challenges*. Instruments for Sustainable Private Sector Forestry Series. International Institute for Environment and Development, London. 27 February 2005 [http://www.iied.org/docs/flu/psf\\_priv\\_sustforest.pdf](http://www.iied.org/docs/flu/psf_priv_sustforest.pdf)

Landell-Mills, Natasha and Porras, Ina, T. (2002, March). *Silver Bullet Or Fools' Gold? A Global Review of Markets for Forest Environmental Services and Their Impact on the Poor*. Instruments For Sustainable Private Sector Forestry Series. International Institute for Environment and Development, London. 27 February 2005 [http://www.iied.org/docs/flu/psf/psf\\_silvbullet.pdf](http://www.iied.org/docs/flu/psf/psf_silvbullet.pdf)

Mathis, Rock. *Net Present Value*. 4 June 2004 <http://www.prenhall.com/divisions/bp/app/cfldemo/CB/NetPresentValue.html>

Metafore. *Comparison of forest certification systems operating in North America*. 15 May 2004 <http://www.certifiedwood.org>

North American Forest Commission. "State of Forestry in the United States of America," *Item 2(c) of the Provisional Agenda*. 4 June 2004 [http://www.fao.org/docrep/meeting/x4995e.htm#P160\\_22670](http://www.fao.org/docrep/meeting/x4995e.htm#P160_22670)

Office of Federal Procurement Policy. *Federal Acquisition Regulation*. Code of Federal Regulations, Chapter 1, Title 48.

Office of the Deputy Director of Defense Procurement for Cost, Pricing, and Finance. *Contract pricing reference guides*. 16 September 2004 <http://www.acq.osd.mil/dpap/contractpricing/vol3chap5.htm>, Sep 2004.

Office of the Federal Environmental Executive. *Green purchasing*. 14 May 2004 <http://www.ofee.gov/gp/gp.htm>

Office of the Federal Environmental Executive. *Paper calculator*. 14 May 2004 <http://www.ofee.gov/recycled/cal-index.htm>

Oregon Department of Forestry. *Log price information*. 5 February 2005  
[http://www.odf.state.or.us/DIVISIONS/management/asset\\_management/  
logppage.asp](http://www.odf.state.or.us/DIVISIONS/management/asset_management/logppage.asp)

Paper Task Force. (1995). White paper No. 10A: Environmental comparison – manufacturing technologies for virgin and recycled-content printing and writing paper. 14 May 2004 [http://www.edf.org/documents/  
1629\\_WP10A.pdf#search='paper%20task%20force%2010a'](http://www.edf.org/documents/1629_WP10A.pdf#search='paper%20task%20force%2010a')

Pearce, David W. The Economic Value of Forest Ecosystems. *Ecosystem Health*, 7(4): 284-296. 2001.

Petering, Karen. "Air Force Government Purchase Card (GPC) Program." Briefing. 25 Aug 04.

Poch, L., Gillette, J. and John Veil. "Comparative Analysis of EPA Cost-Benefit Methodologies," *Fossil Energy*, 5 (May 1998).

Point Carbon (2005, January 31). *Carbon market daily*. 1(1). 5 February 2005  
[http://www.pointcarbon.com/wimages/CMD31\\_01.pdf](http://www.pointcarbon.com/wimages/CMD31_01.pdf)

President of the United States of America. *Federal Acquisition, Waste Prevention, and Recycling*. Executive Order No. 12873. Washington: GPO, 20 October 1993.

President of the United States of America. *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy*. Executive Order No. 12780. Washington: GPO, 31 October 1991.

President Of the United States of America. *Greening the Government through Leadership in Environmental Management*. Executive Order No. 13148. Washington: GPO, 24 September 1998.

President of the United States of America. *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*. Executive Order No. 13101. Washington: GPO, 24 September 1998.

Repa, Ed. "Tipping through time." *Waste Age*, 33(11): 72 (2002).

The Committee for Purchase from People Who Are Blind or Severely Disabled. *Products List*. 13 December 2004 [http://www.jwod.gov/jwod/  
p\\_and\\_s/downloads.asp](http://www.jwod.gov/jwod/p_and_s/downloads.asp)

United Nations Environment Programme. *Original Forest Cover*. Retrieved June 2, 2004 from [http://www.unep-wcmc.org/index.html?http://www.unep-wcmc.org/forest/  
original.htm~main](http://www.unep-wcmc.org/index.html?http://www.unep-wcmc.org/forest/original.htm~main)

United States Congress. *Clean Air Act of 1970*. United States Code, Title 42, Chapter 85, Subchapter I.

United States Congress. *Resource Conservation and Recovery Act of 1976*. United States Code, Title 42, Chapter 82, Subchapter I.

Vlosky, R. P., Gazo, R., & Cassens, D. (2003). "What Do Manufacturers Think About Certification?" *FDM*, 75(13), 76-79.

Woodley, Stephen and others. (1999). *North American test of criteria and indicators of sustainable forestry*. 2 March 2005 [http://www.fs.fed.us/institute/cifor/cifor\\_1.html](http://www.fs.fed.us/institute/cifor/cifor_1.html)

## **Vita**

Capt Silinda Johnson graduated from McIntosh High School in Peachtree City, Georgia in June, 1994. She received her Bachelor of Science in Applied Biology from the Georgia Institute of Technology in 1998, and was commissioned a second lieutenant in the United States Air Force in June, 1998.

Her first assignment was to the Air Armament Center (AFMC), Eglin Air Force Base, Florida where she worked as a contract specialist in the operational contracting squadron. While at Eglin, she also worked at the Range Instrumentation System Program Office. Next, she went to Brooks City-Base, Texas and worked at the Headquarters Air Force Center for Environmental Excellence, first as a contract manager then as a contracting officer. While at Brooks, she deployed for three-months as a contracting officer at Camp Doha, Kuwait during Operation Enduring Freedom. In August 2003, she entered the Graduate School of Engineering and Management at the Air Force Institute of Technology as a Strategic Purchasing Student. Upon graduation, she will be assigned to Warner Robins Air Force Base, Georgia.

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1. REPORT DATE (DD-MM-YYYY) 08-03-2005	2. REPORT TYPE Master's Thesis	3. DATES COVERED (From – To) Aug 2004 – Mar 2005		
4. TITLE AND SUBTITLE  The Feasibility of the U.S. Air Force Mandating the Exclusive Use and Purchase of Forest Stewardship Council Certified Wood and Paper Containing 100% Post Consumer Content			5a. CONTRACT NUMBER	5b. GRANT NUMBER
			5c. PROGRAM ELEMENT NUMBER	5d. PROJECT NUMBER
			5e. TASK NUMBER	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S) Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 Hobson Way WPAFB OH 45433-7765			8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/GSP/ENV/05M-04	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSOR/MONITOR'S ACRONYM(S)	11. SPONSOR/MONITOR'S REPORT NUMBER(S)
12. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT The Resource Conservation and Recovery Act required federal agencies to purchase products with the highest recovered content (or post consumer content in the case of paper) as practicable. The Office of Federal Procurement Policy required all executive agencies to give preference in their procurement programs to products that conserve natural resources and protect the environment. These requirements necessitate that the Air Force consider purchasing 100% post consumer content (PCC) paper and Forest Stewardship Council (FSC) certified wood because of their environmentally preferable attributes. This study compared the availability, performance standards, and prices of 100% PCC paper to 30% PCC paper and FSC-certified wood to uncertified wood. Life cycle costs were included in the price comparisons. It was determined that 100% PCC paper was equally available; met the same performance standards; and could be found at prices equal to or less than the price of 30% PCC paper. It was also determined that FSC-certified wood met the same performance standards as uncertified wood, but was not readily available. Additional data would be required to compare the price of FSC-certified wood to uncertified wood. For these reasons, it was determined that it would be feasible for the Air Force to require the exclusive use and purchase of 100% PCC paper and not feasible to require the exclusive use and purchase of FSC-certified wood.				
15. SUBJECT TERMS Paper, Lumber, Recycled Materials, Procurement				
16. SECURITY CLASSIFICATION OF: REPORT U		17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 91	19a. NAME OF RESPONSIBLE PERSON Ellen C. England, LtCol, USAF (ENV)  19b. TELEPHONE NUMBER (Include area code) (937) 255-3636, ext 4711; e-mail: Ellen.England@afit.edu

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